MECHANICS' MAGAZINE.

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NOTICES OF AGRICULTURAL AND HORTICULTURAL WORKS.

MAGAZINE OF HORTICULTURE.—Formerly known as the Gardener's Magazine. The January Number of this work is highly interesting and original. The article on "the progress of Horticulture in the United States," by A. J. Downing, of Newburgh, is full of interest, we shall notice some particulars of it at another time.

FARMERS' REGISTER.—This work also commences the year with a very fair number. Several articles in it gave us great pleasure in the perusal.

SCIENTIFIC AND LITERARY JOURNAL.—This work is a continuation of the Scientific Tracts, so well known for neatness of execution and value of matter. The new and enlarged form of the work will retain the same character.

A TREATISE ON THE PRINCIPAL MATHEMATICAL INSTRUMENTS, EMPLOYED IN SURVEYING, LEVELLING, AND ASTRONOMY, explaining their construction, adjustments, and use, with tables, by T. W. SIMMS, Assistant at the Royal Observatory, Greenwich. Revised with additions by J. H. ALEXANDER, Civil Engineer—F. Lucas, Jr., Baltimore. An American edition of an English work, written by a gentleman well versed in the scientific and practical knowledge of Instruments.

The principles of the construction of the instruments are clearly explained, aided by very good cuts—and the details of their adjustment, are very well described.

The latter subjects are followed out at length as regards both Surveying and Astronomical Instruments.

The value of the work is also increased, by the Tables at the end—they are of great use to Engineers, Surveyors, and Astronomers.

The portability of the work is a great recommendation, and the information added in the American Edition, being suited to the practice of the profession in this country, it will be found one of the most useful and convenient works that an Engineer can use.

While on this subject, we must remark, that the principles of construction and adjustment of many of the most commonly used Surveying Instruments, are far from being well understood. Mistakes of the most glaring nature have come under our own observation, and in persons otherwise thoroughly understanding their instruments.

Instruments are also very liable to get out of order while in use, and that too in places where an instrument maker would be a *rara avis*. To all persons in such a predicament, a slight knowledge of the principles of construction of their instruments will be invaluable.

We know of no work more useful in all such emergencies, than this treatise of Mr. Simms.

Extract from a file of the "Journal des Debats" kept at the reading rooms of the "Young Men's Association" in the city of Albany. Nov. 5, 1836. From Correspondent.

"Monsieur Chaix a Frenchman by birth, and long a resident of the Island of France, has made a discovery of great interest to

Steam Navigation. The boilers of Engines, as is generally known, are after a short use covered internally with a hard crust, principally composed of calcareous sub stance, which prevent the transmission of heat from the furnace, to the water contained in the boilers; increases the already heavy expense of fuel, and often causes the formation of fissures and cracks which require costly repairs. M. Chaix has discovered a means as simple as it is ingenious to prevent the formations of these incrustations. His process has been tested by order of the Navy Commissioners at Toulon on board the Government Steamboat *Phare*.— It has been proved by a committee appointed for the purpose that not only are incrustations prevented by the process, but also that old formations are detached by it. The discovery is patented. We trust however, that our Government may be induced to repeat the trial, and if as successful as when first tested, purchase the discoverers right for the nation and the interest of Steam Navigation generally."

CHESS—BROMUS SECALINUS.

Many of our agricultural papers have recently published articles on the subject of the conversion or degeneration of Wheat into Chess. We have been rather surprised to find that several have embraced the opinion that such change does really take place.

They rest the proof of their position upon the supposed facts, that chess has been found growing from a grain of wheat, and that clean wheat, sown on certain kinds of ground, has returned almost nothing but chess.

Many persons might be deceived by an instance of the first case, while a careful examination would show their error. We have heard of several supposed cases, of a stalk of chess growing from a grain of wheat, where a close examination by a skilful observer has detected the mistake.

As to the latter case, in the same way, we have seen wheat and rye turned into what are commonly called *wild turnips*.— Improper seeds may exist in the soil previous to the sowing of pure grain, and these will most assuredly come up and flourish as well as the good grain, and sometimes, being more hardy or earlier, may altogether overcome it.

It is a principle in nature, that genuine distinctions can by no process of art be changed, the one into the other, and wheat and chess belong to very distinctly different genera. It is not even likely that the pollen of the one, fertilizing the pistils of the other, has produced a mongrel or hybrid, for we do not hear of any intermediate plant, such as would be the result of a mixture.

Providence has wisely appointed, that what a man sows he shall reap, and does not suffer him to receive in return for the most useful of all grains, a useless and even deleterious seed.

We should not have noticed this matter, had we not seen in print several articles, evidently written by firm believers in vegetable transubstantiation. Desiring to correct a heresy so gross, we have entered our protest against it.

The serious effects said to be produced by a large quantity of chess ground up with wheat, as giddiness and delirium, render it an important object to get rid of this plant. We suspect that sowing clean grain on clean ground will be found the very best method of accomplishing this object.

From the Journal of the Franklin Institute.

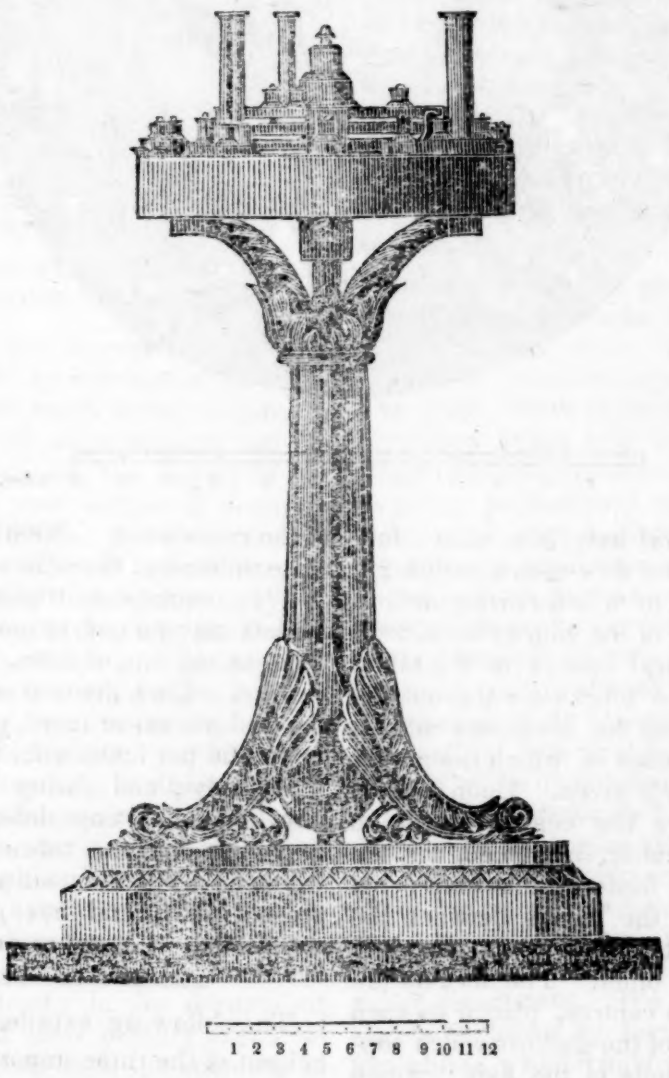
DESCRIPTION OF A MACHINE FOR MILLING COIN, INVENTED AND INTRODUCED INTO THE MINT OF THE UNITED STATES; BY FRANKLIN PEALE.

For the purpose of reducing manual labor, and expediting the processes of the Mint, I was induced, during the latter part of the last year, to make designs for the

construction of a Milling machine, to be propelled by the steam power ordinarily employed in the Mint, a model of which I had the honor to exhibit at one of the late conversation meetings of the Institute — From these designs and model, the machines to which this communication relates, have been most satisfactorily executed in the workshops of the Mint, and are now in full operation in the coining department.

To those who are unacquainted with Mint operations, it will be well to explain, that the operation of milling has for its object, to throw up a thickened edge upon the *blanks* or *planchets*, previous to their being struck, by which means a better border can be given to the coin, with less labor or injury to the dies, it is also, sometimes employed to impress letters or ornaments upon the edge of the coins.

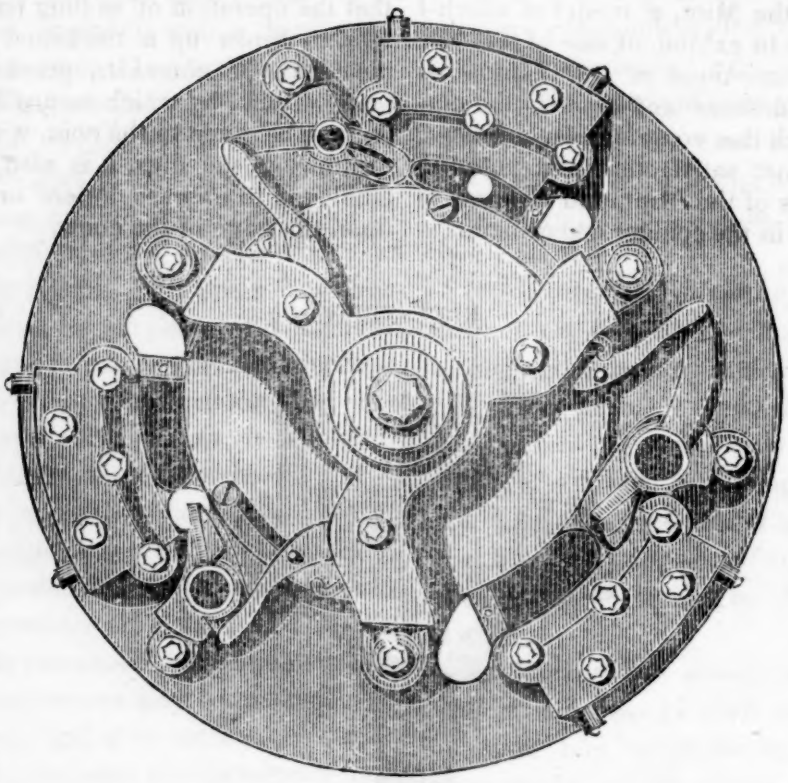
ELEVATION.

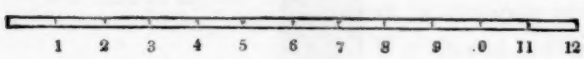


1 2 3 4 5 6 7 8 9 10 11 12

A classical tripod, of cast-iron, supports the table on which are placed the feeding tubes and dies; through the centre of the stand a vertical shaft rises from the room beneath, on the lower end of which is a pulley and its band, furnished with a clutch box, by means of which, movement is given, or arrested, as occasion requires. A winch handle may be applied to the hexagonal top of the axis, for the purpose of adjustment, or to propel the machine, if required, by manual force.

HORIZONTAL VIEW.





Upon the central axis is a wheel, furnished with two steel dies upon it periphery, the length of each of which corresponds to the circumference of the coin to be milled; and on the trilateral spaces of the table, are firmly screwed blocks for the outside dies, furnished with the necessary adjusting screws, by means of which the proper degree of pressure is given. Upon the axis immediately above the central wheel, an oval *cam*, or *eccentric*, is placed, for the movement of the feeders; this cam is set in *time* to place the blanks between the dies, when the extremities of the latter are opposite to each other. The feeders are *levers*, moving on centres, placed on each of the three arms of the gallows which supports the upper ends of the axis; which *levers* are kept against the cam by spiral springs, contained within a cavity at the centre of motion. A circular blade, or *pitcher*, as it is technically called, takes the lowest blank from the pile contained in the feeding tubes, and pushes it forward, at the required moment, and a light curved spring prevents its being thrown in advance of the movement. Nearly all of the parts are exhibited in the annexed views.

This machine is triplicate, and all its feeders may be put in motion at the same time, or any one of them, as occasion may require. Each division is capable of milling 200 pieces, or more, per minute, equal to 12,000 per hour, with the attendance of a boy only; and during this rapid operation, separates any defective pieces that may pass into the tubes. This machine has been in operation since February of the present year, and has given unqualified satisfaction in every respect.

The following excellent article on the subject of the three important scientific enterprises undertaken by our government, is from the pen of a gentleman who has paied much attention to these subjects, and is practically and theoretically, well qualified to speak concerning them. The labors of Mr. Hassler are not as well understood and appreciated in this country

as in Europe. Several of the most eminent of modern astronomers have given most complimentary testimony to his peculiar fitness for so great an undertaking. Yet with all this, will it be credited that the compensation of the superintendant of the coast survey of the United States, is only $3000 a year—this is *tendered* (for the honor of our country, we will not say, *considered*) a suitable compensation to one of the first astronomers of the day, engaged in one of the most delicate, and at the same time, extensive geodetical works ever undertaken.

On these subjects we have more to say—we shall again speak of them when time and space will permit.

From the Albany Argus.

SOUTH SEA EXPEDITION—SURVEY OF THE COAST—WEIGHTS AND MEASURES.

Sir,—Among the several national projects mentioned in the message of the President, and the documents accompanying it, I have noticed with much pleasure that the South Sea Expedition, the survey of the Coast, and the manufacture of standard Weights and Measures, have received peculiar attention. This is appropriate, inasmuch as each of these works may be considered important, not only for the peculiar desiderata intended to be supplied by their proper execution, but as patronizing and bringing into contact and action the science of the country. The notice given by the President to these among other objects of more particular and immediate concern, is therefore gratifying as indicative of a high and proper estimate of their value. It appears indeed, that in each of these undertakings, certain minor troubles have arisen, sometimes from lack of sufficient authority in the department having charge of their primary organization—and sometimes from the operation of that necessary rivalry among officers and professional gentlemen exercising functions of a different nature, when they are for the first time made subject to a sole and unaccustomed authority. Bad effects may have also originated from a cause known to operate to a certain extent throughout the country, viz., an indisposition to patronize foreigners of distinguished talent; or to use them only till they had initiated us into the details of some scientific process, and then whistle them off to provide for themselves. This is a mawkish and dishonorable feeling, which can exist only in young communities, and which we hope soon to see extirpated entirely from this.—When Miller, the musician, found Herschel, the astronomer, an obscure clarionet player, in the band of a country village in England, and invited him to share his lodging, it can scarce be believed that the patronage of the Englishman was either stinted, or unpleasant, because his protege was a German. Nor have we ever heard that Englishmen have been jealous of the elder Herschel, because he was a native of another country than their own—nor refused on that account to display his discoveries among their proudest conquests in science.

But in regard to a proper execution, in this country, of works having relation to general science, rather than to any appropriation of its advantages to our own use and profit, there is, perhaps, yet another incapacity lying still deeper, and which reults from the circumstance that we have as yet no predominant scientific establishment, or national institute, which, possessing alike the confidence of the government and the nation, can take cognizance *of*, and give recommendation *for*, the proper conduct of projects of this character. Heretofore the charge of such works has always been assigned by Congress to the Executive, and by him committed to some one or other of the departments. Now, though each of the Secretaries has his appropriate function in managing the correspondence, the defence, the currency and commerce of the nation, still to none of them belongs, in a special manner, the patronage of science, unless as it affects his own peculiar department. We may expect them also to be bound by legal restrictions and formalities, which could all have been foreseen and obviated in the sittings of such a national academy as I have described.—That the efforts of the government have been retarded and deranged from the lack of such an institution, is evident from the statement of the message, that the duties of the President, and Secretary of the Treasury, have been too multifarious and

burthensome to permit the requisite attention to certain of these public works. I do not make these suggestions invidiously, or for any bad purpose—the official communications give themselves the authority for the facts; and though I am of opinion that the recommendation of the message, to invest a separate board with the control of such works, must tend only to multiply official relations already too numerous, and increase a correspondence already complained of,—still the deference due to the highest authority in the nation shall prevent me, for the present, from entering into any argument on the subject. I propose to myself a more pleasant duty, in presenting through your columns, nearly the present state and prospects of these public works. And I do this mainly for the reason that from us, of New-York, they have seemed to receive less notice than they deserve.

Of the expedition to the South Seas, little at present can be said, as its preparations and arrangements are yet imperfect. The difficulty in procuring the necessary equipment for the ships, is the matter principally complained of in the report of the Secretary of the Navy. This must have been foreseen, and is undoubtedly fortunate, as affording more time to mature the plan of the voyage, and to organise and discipline its equipage. We are, I know, as a nation, prone to do things in a hurry; but this prevailing passion should not be indulged here. The proper arrangement of an expedition, whose results are to be judged of by the whole scientific world, cannot be too well thought of, or too carefully defined. If a scientific project fail in our own hands, we have only to take care that the failure be not known: but this will not answer here. The results of the expedition must become the property of the world, and there will be no honor unless they be worthy of the nation.

The two other projects mentioned in the message,—and which I have endeavored to class generically with the first, as of a character partaking rather of the encouragement due by the government to science in general, than of any exclusive appropriation of its advantages to the wants of the community,—are the Survey of the Coast, and the establishment of an uniform Standard of Weights and Measures.—

These two works have been in progress for about the same period, under the direction of the same superintendent, Professor F. R. Hassler. And it is more our duty of New-York to understand them fully, not only because, from our extensive commercial relations, a proper execution of these works is more important to us than to any other section of the confederacy, but because the superintendent, though a foreigner, has by a residence among us of more than thirty years, given us a right to claim him as one of the citizens of this State, and imposed upon us the duty to encourage and patronize him in his labors. He has many claims to our consideration, but it is the fashion now to speak of things and not of men. I will, therefore, briefly refer to the progress of these two works, since they have been committed to him.

A survey of our extensive Coast was first found necessary about the year 1805. It had then been discovered by American statesmen, that parent countries always keep the commercial knowledge of their colonies as a leading string in their own hands—and that as practical navigators, American seamen know less of their own shores, than the country and its allies from whose subjection we had so recently delivered ourselves by force of arms. In large vessels, three nations, the Dutch, the French, and the English, approached our harbors with less risk than those bearing our own flag: at the same time that in small and more manageable vessels, we had long been known as a match for the strongest. The President—Jefferson—saw the defect and the manner in which it must be remedied. We were at that time on the brink of a war, about whose justice some of our politicians differed in opinion, and it was of course more necessary to *pray* for a fortunate resalt than to *preach* of the causes which had occasioned the quarrel. To have procured for the nation (even if it had been practicable so to do,) the old charts from the Dutch, French, and English governments, would have only been to put our knowledge on a par with theirs—while to execute more recent and accurate surveys, was advancing the new country above the old With the clear and bold perception, which always distinguishes men of genius, when they are entrusted in times of danger with the destinies of a nation,

the President recommended a survey of the whole coast, with all the aid of the more recent discoveries in science. The survey as recommended by him was to be of the kind then recently executed in France, and in progress in England. It was to cover the whole defensible part of the seaboard, extending from the shores to the gorges and defiles of the first highlands:—to be bases upon a primary triangulation, with sides of from 10 to 60 miles in length, affording at once the advantage of confining the errors incident to every similar operation, within the nearest limit in the longest distances, while it supplied the greatest facility both from the number and accuracy of points merely of detail. The project unfortunately was in advance of the science of the country. The perfection possible to be given to circular instruments was not then much understood; and the matter most creditable to the country, both in the design and execution, escaped in a great degree both notice and commendation.—There were then few men among us to whom the excitement incident to the birth of a new nation and the organization of a new government, had allowed sufficient of leisure to think of the means by which its future destinies might be improved or illustrated. The survey of the coast was of course discontinued. In 1832, under the present administration, it was revived, and has been continued to the present day; the primary triangulation having been conducted by the superintendent, and the detail-topography and sounding either by junior officers of the army and navy, or by civil engineers, to whom the honor of employment in an important work has been sufficient inducement to attract them into the service.

The work has advanced from near the mouth of the Connecticut to the Delaware, above Philadelphia, and there seems to exist no impediment to its future progress, except what has arisen from some misapprehension as to the powers and compensation of the superintendent. He, as we learn from the documents, is allowed $3000 per annum, with his expenses—a sum so evidently incongruous with other salaries, that I perceive it has not yet been registered in the blue book, doubtless for fear that in the eyes of foreign nations it might reproach us of penury when we have plenty. This has, I presume, only resulted from lack of sufficient authority in the law authorizing the work; and as it is now submitted to Congress, this difficulty will of course be removed. Men should always be paid in proportion to the talent and industry which they expend in the public service; for if an opposite principle be once admitted, not only will the service deteriorate in character, but the government will lose the most distinguished feature of a republic—all employments, whether of trust or of honor, must become the property of the rich, for to such only the compensation could be a minor consideration.

To the same superintendence has also been confided the construction of standard weights and measures. The lack of uniformity in this particular, and which in the simple but just language of the superintendent, "*amounted to an actual distribution of injustice*,"* had been repeatedly presented by the Executive for the consideration of the nation. This work was preceded by a preliminary comparison of the different weights and measures used in the country, which were also, so far as they deserved such notice, referred to the later and better authenticated standard of foreign nations, than extant among us. Finally, the unit of length adopted was the mean yard of a scale of 82 inches, made by the late celebrated Troughton, for the survey of the coast: and which is one of a family of scales by which the standard of English measure has been preserved. The base of the system of weight was determined, as in England, by the Troy pound; that weight having always been used in the English mint, and among the dealers in gold and in medicine. The wine gallon and Winchester bushel were also taken at their English statutory dimension. But in measuring the standards of capacity, it was determined instead of taking water at the temperature of melting ice, (a fixed point of the thermometer,) as the French have done, or the mean temperature of the climate, as has been used by the English, to take the weight of water at its *maximum* density: a point as fixed in its temperature, and more certain in its ultimate results.—In this matter, the skill and judgment both of Professor Hassler and of Mr. Ingham,

* Document 299, of the year 1832.

the then Secretary of the Treasury, have been eminently apparent. A like discrimination, though at first not so palpable, is manifest in the choice made of brass for the compound in which the standards were to be executed. The ordidary measures in use for purposes of commerce would most appropriately be made of this material, as less liable to oxidization, and it was held important that the prime standards kept only to authenticate those in common use should be of the same metal. To avoid, however, the uncertainty of expansion in a compound metal, the brass used for the standards has all been cast by the same process from pure zinc and copper, the produce of mines of our own country; it is therefore tough, hard, and of uniform density.

I have been induced to take this notice of these public works, finding, from conversation, that but *little* was known about them, and of course *less* interest taken in their proper execution than they deserve. This has not been the case in Europe, where the details of their construction have received more notice than have been conferred on any other scientific works instituted in this country. The latest documents concerning them are contained in a special letter from the Treasury Department of the 8th December.

METRIQUE.

We adverted three or four days ago to the importance of the Susquehanna Canal to the interests of Baltimore, and we hinted at the obligation which consequently rested upon our citizens of making extraordinary efforts to complete the work at the earliest possible period. Besides placing Baltimore in a most commanding position for the enjoyment of the immense trade which seeks a market through the Ohio and Pennsylvania State Canals, and enabling her to enter into advantageous competition for supplying the West with merchandize, the Canal to tide will throw open the vast Coal regions of the Susquehanna, and thus create a new trade of incalculable value to the commerce of the Chesapeake Bay, and of this its principal city. The importance of this single item is thus earnestly dwelt upon in the following editorial article, published in the Harrisburg Intelligencer of the 5th instant:—[American.]

COAL—SUSQUEHANNA CANAL.

A writer in the United States Gazette, says, that when the Canal, that is now making, from Columbia to tide, is finished, which will be in two years, the Anthracite Coal of the Wyoming valley will be carried in immense quantities to market. He states that "COMPANIES HAVE ALREADY BEEN FORMED, *composed principally of citizens of New-York, to carry coal down the canal to Port Deposit, and from thence by sloops to the Eastern cities.*" We have no doubt of this. The completion of the canal to tide, will be a new era in the coal trade. It is now confined to the Lehigh and Schuylkill, whose coal fields, great and important as they are, are small in comparison to those on the Susquehanna, stretching from Lykens valley on the South, more than one hundred miles, to the head of Wyoming valley on the North. *We predict that in less than ten years, that such an amount of coal will pass down the Susquehanna, that more sloops will be loaded at its mouth, than are now employed in the coasting trade of the whole Union.*

Fortunes will be made by the owners of coal hills. At this time coal lands can be purchased reasonably. In Lykens valley, only eighty miles from tide, and one hundred nearer market than the Wyoming, are fortunes to be made. Here is an immense coal mountain, and a railroad connecting it with the river. The coal is superior to any other, for its easy ignition and purity. The owners, especially those on the North side of the mountain, have not yet found out their great value; and yet only on a few acres in the twenty thousand, are there any mines opened. We understand that a Boston company have purchased a portion of the valuable mines of Messrs. Elder & Haldeman. There are still other chances here which we presume will not be long neglected.

A highly curious and valuable antique has recently been discovered at Weston, near Bath. It is of pure silver, hexagonal, of a tapering form, and about 14 inches in length. The top is cornet-shaped, ornamented with acanthus leaves, and was attached probably to the handle. It has been conjectured that this article was employed to hold a torch to light a funeral pile, and to be Roman.—[Bath Herald.]

The rotary printing machine of Mr. Rowland Hill has already excited much attention. We have had the specification of the patent with the accompaning drawings for some time in our possession, but the length of the former and the intricacy of the latter, have prevented us from publishing them. The following article giving a description of the machine is from the Repertory of Patent Inventions, and will be found to convey a very correct notion of the machine without reference to details.

THE ROTARY PRINTING MACHINE BY MR. ROWLAND HILL.

The steam-printing press was introduced at the close of the year 1814, before which time all printing was done by hand-presses, and the rate at which large sheets as newspapers were printed, scarcely ever exceeded 300 single impressions* in an hour.

The insufficiency of the hand-press to meet the growing demands of the public for newspapers was probably felt at a much earlier time, as in the year 1790, Mr. William Nicholson, editor of the journal bearing his name, obtained a patent for machines for printing upon various plans, and it is certainly the case that he then *indicated* very many of the modes of operation which, since his time, have been successfully developed by other machinists. Mr. Nicholson appears never to have carried out any of his plans to a successful termination. Whether he was unable to work out the numerous mechanical details, or wanted funds to meet the heavy and unavoidable expense of such undertakings, or could not induce those engaged in the trade to give his plans a fair trial, we have no means of ascertaining; certain it is, that whether succeeding machinists have or have not been indebted to him for their leading views, they have had still to encounter by far the most difficult part of their task, and in overcoming the various physical and mechanical difficulties which lay in their way their powers of invention and their patience and industry must have been exercised in no ordinary degree.

When, however, the machine-presses were brought into action a great increase of speed was at once obtained.

During the twenty-one years which have elapsed since their introduction, various and important improvements have been effected in their construction, and by the rapid and powerful machines now used in printing the daily newspapers, the surprising number of 4000 single impressions is sometimes given off in an hour.

The inventor of the machine, which is the subject of this paper, believes that he has effected improvements by which the rate ef printing just named, great as it is, may be still further increased, and that in no trifling degree.

In order to explain the means by which this advantage is proposed to be obtained, it is necessary to notice slowly the construction of the machines now commonly in use.

The type necessary to the printing of one side of the sheet, consisting (for a newspaper,) of about 100,000 separate pieces, are collected, and being arranged in proper columns, the mass is placed in an iron frame called a chase, which binds it firmly together, and the *form* (as the chase filled with type is technically called) is then transferred to the machine, where it is secured upon a strong iron plate, which plate being mounted upon truck wheels, forms a carriage; and there is a small railroad for it to run upon.

When the machine is in action this carriage, with the form upon it, of which the face* of the type constitutes the upper surface, is constantly moved backward and forward horizontal y, and as it passes along, it comes in contact, first, with the inking apparatus, which consists principally of a number of cylindrical rollers covered with ink and lying horizontally, and which are set in motion by the friction of the surface of the type acting upon their lower sides as it runs under them.

Next the *form*, being now inked, passes under a large revolving iron cylinder about the form and size of an ordinary double drum; this lies horizontally, and its curved surface is covered by a closely wove blanket bound tightly upon it.

The paper as it is supplied to the machine, is made partly to encircle this cylinder, being held against it by tapes which move with the cylinder.

The surface of the type moving horizontally and the surface of the blanket-covered cylinder revolving with the paper upon it, have exactly the same speed, and as the type

* Impressions on one side only of the sheet of paper.

* That part which gives the impression.

passes under the cylinder, that side of the cylinder which bears the paper is brought undermost and presses the paper upon the type whereby it is printed. The cylinder then rises a little, the type returns under it without contact and passes back to the inking rollers for another supply of ink, preparatory to the printing of another sheet ; while the printed sheet, if the machine be constructed to hold one form only, now passes out from between the cylinder and the tapes, and is received by an attendant.

Simple and ingenious as this arrangement undoubtedly is, the experienced machinist will at once perceive that it has points in which improvement is at least highly desirable.

That which is most objectionable is the reciprocating motion of the form and its carriage, which together are of considerable weight, varying perhaps from five cwt. to a ton, and it is obviously difficult, if not impossible, to keep such a heavy mass in very rapid motion when the direction of that motion has to be reversed every instant.

Also much time is occupied by the backward motion of the *form* by which the type obtains a supply of ink, and regains the position proper for the printing of a succeeding sheet.

And the rate of reciprocating motion really obtained, though not great, requires much power to produce it.

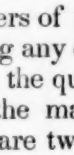
These defects appear to be unavoidable while the type forms a flat surface, as it is not practicable to make a flat surface move continuously.

Mr. Hill proposes to obviate these defects by affixing the type around a cylinder so that the surface of the type itself shall form a kind of outer cylinder, the whole resembling slightly an organ barrel with its projecting pins ; and he has certainly overcome the principal difficulty as it appears, viz., the discovery of a mode of readily and securely attaching the pieces of type to the cylinder, and this without making it difficult to detach them for the purposes of correction, revisal, &c. Of the manner in which this is accomplished we shall speak presently.

The type so affixed upon a cylinder, together with the proper spaces for margin, occupy its whole circumference ; the cylinder thus clothed is placed in contact with a blanket-covered cylinder of the same dimensions, and the two are connected by toothed wheels, and the paper is passed between them with moderate compression, just as a piece of metal is passed between the rolls of a flatting mill. An inking apparatus is attached by which a constant supply of ink is communicated to the type as it revolves.

As the type cylinder has affixed to it precisely the quantity of type requisite for printing a sheet on one side ; and as there is no vacant space upon the cylinder except for the margins, it follows that at each revolution of the cylinder exactly one sheet will be printed ; and that the instant the printing of one sheet is completed, that of another will be commenced ; no loss of time therefore can occur if the supply of paper and of ink be kept up.

Again the motion being rotatory, not reciprocating, there is no difficulty in making it rapid ; and the machine has been repeatedly worked with great rapidity in the presence of numbers of persons, without injuring or disturbing any of its parts, and without deteriorating the quality of the printing.

In the machine which has been exhibited, there are two type* cylinders and two blanket cylinders placed thus  : the paper in passing from left to right between the first rollers is printed upon its upper side, and in passing between the last rollers it has its lower side printed.

This arrangement, of course, requires two distinct inking apparatus, one for each type roller.

To supply the machine with paper in single sheets at the rate of two per second, at which rate the machine has hitherto been worked, would be difficult if not impracticable ; the plan therefore has been to make use of a long scroll of paper as it is produced by the ordinary paper machines, the end of which being introduced between the rollers the machine then supplies itself by unwinding the scroll from a reel.

It is intended to cut the scroll up into single sheets by additional machinery, as it passes from the printing rollers.

The greatest difficulty which Mr. Hill has had to surmount in the construction of his machine, is, as we have already stated, that of fastening the small pieces of type upon the surface of a cylinder, and with firmness to

* One only has been covered with moveable type, the other has stereotype plates bound round it as a temporary arrangement.

retain their places even when they are turned upside downwards by the revolution of the cylinder, at which time their gravity combines with their centrifugal force in tending to displace them, and to effect this without throwing new difficulties in the way of correction, revisal, &c. We shall endeavor to explain how this is accomplished.

Each piece of type is slightly wedge-like in its form, so that when several are laid side by side, they form a segment or arch whose lower curve corresponds to the surface of the cylinder upon which the type is to be fixed,* and each piece, instead of the ordinary narrow notches in its side, made for the compositors convenience, has a very broad notch; when the type is placed together to form a line these broad notches in the several pieces range together, and form an arched chase capable of receiving a thin brass plate of corresponding form and dimensions, which, when applied, is wholly embedded in the chase. When a line of type with its plate, or scale-board, so embedded within its substance, is compressed between the lines, and its plate thereby completely inclosed and kept in its place, it is manifest that no single piece of type can be displaced: if any move the whole line must move. Means have been adopted, which we have not space to describe, by which these plates are made to take their places in the course of the composition, with the utmost readiness and certainty.

The lines of type are placed in a kind of tray or galley, of the length and breadth of a newspaper column; the bottom of which tray is a portion of a cylinder, the curvature being in its breadth, not in its length, somewhat as though a stave were taken from a truly cylindrical cask, and used as the bottom of a tray, the curved side being uppermost. The lines of type are secured in the tray principally by horizontal screw pressure acting against the ends of the column of type; but as a precaution against a tendency to bulge, which sometimes occurs in a column of the great length required in a newspaper, a few of the embedded plates have small projecting tenons at their ends, which lock into certain chases in the sides of the tray just described.

The upper type-cylinder of the machine exhibited has ten such trays answering to the ten columns upon one side of a newspaper*; each tray being filled with type has a proof taken from it by a small press, and, after correction, the type being made fast by tightening the horizontal screws with which the galley is provided, the galley itself is screwed upon the cylinder. When the ten galleys are so attached to the cylinder, they cover it completely, excepting the spaces left for margin, but any one galley can be easily removed and replaced without disturbing any other.

The galleys filled with type being firmly screwed to the cylinder, thenceforward form part of it, and are not removed until the printing is completed and the type is to be taken out for distribution, unless it should become necessary to stop the press for further revisal or the insertion of new matter.

The very rapid supply of ink which the machine demands, by reason of its great speed, appears to be fully maintained, and that with very good color, by the inking apparatus attached.

Mr. Hill employs the trough (for containing the ink,) with its ductor-blade and iron roller, having proper screws for increasing or diminishing the space between the blade and the roller, through which space a thin film of ink adhering to the surface of the roller passes from the trough as the roller revolves.

This ductor is in every respect of the usual construction; its roller turns very slowly; next to it Mr. Hill places another iron roller lying parallel with it and just touching it, but having a rapid motion equal to that of the surface of the type, and this roller by gently but swiftly rubbing against the ductor-roller, takes off its ink in a much thinner and more extended film. It ordinarily moves about eighteen times as fast as the ductor-roller, therefore it ordinarily extends the film of ink brought out by the slow-moving ductor roller over eighteen times the amount of surface it first occupied.

Means are provided by which the relative speed of the ductor can he readily increased or diminished, and thus a very nice adjustment of the quantity of ink supplied to the type can be effected.

We have spoken incidentally of the great speed of Mr. Hill's machine; being worked by two men it throws off sheets of the size of the evening newspapers, at the rate of 7000

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[1] Mr Nicholson proposed to use wedge-like type, and to affix them upon a cylinder, but he did not show any sufficient means of so affixing them.

* The lower type-cylinder, which prints the other side of the paper, is temporarily covered with stereotype plates, as before named.

to 8000 perfected copies per hour. What rate can be safely given to it by the application of steam power it is difficult to determine. At the speed above named, a scroll of paper of the width of a newspaper, and from three miles and a half to four miles long, might be printed on both sides in one hour.

Before the introduction of printing-machines in 1814, the printers of large newspapers, confined in their operations by the slowness of the hand press, had no resource, under the pressure of urgent demand, but to set up a portion of their matter in duplicate, at an expense of some thousands per annum. It seems not improbable that the expected abatement or removal of the stamp duty may soon cause the demand for newspapers to overtask even the great power of the present machines.

Should such a pressure arise, and should Mr. Hill's machine prove as successful in extended practical operation, as the numerous experimental trials it has had give reason to expect, its introduction will probably bring relief in the same way as it was brought up by the introduction of the machines first used.

From the London Mechanics' Magazine.

MODE DISCOVERED OF PROPELLING BALLOONS IN ANY DIRECTION.

Sir,—It is really a matter of no small surprize, that, after all the investigations and experiments made in ærostation, since Albert first asserted, and Montgolfier afterwards demonstrated, the practicability of floating in the upper regions of the atmosphere, that balloons should remain to this day the same unwieldy and ungovernable toys as at first constructed.

After the first principle, or rather the first power of balloons—that of ascension, had been satisfactorily established, both by calculation and experiment, the next thing that became desirable was the power of propelling and guiding them at will.

Various attempts have at different times been made to accomplish this eminently desirable object; but being for the most part made without judgment, they were unattended with successful results. Sufficient has been done, however, to prove beyond all question, *that propellers will act upon a balloon*, with an effect proportionate to their size, and to the manner in which they are placed and worked. It is also equally evident, that so soon as æronauts can, by any means, cause their balloon to move with a velocity differing from that of the current of air in which they are floating, a rudder will become efficient, and the balloon will answer to the helm.

People frequently confuse themselves in their application of the simple principles of navigation in a denser medium *to ærial navigation.*

So long as a boat, barge, &c. moves with the same velocity as the stream, a rudder is wholly useless; but, if the boat or barge is made to move with a different velocity—i. e. *either faster or slower* than the stream—the rudder becomes an efficient agent in directing the movements of the vessel. With balloons, precisely the same law obtains; the moment they can be propelled, they will become capable of being guided.

In a recent Number of your Magazine, Mr. Mackintosh very justly observed, with respect to the difficulty of propulsion, that "the difficulty consists simply in this:—The resistance is greater than any power that has been hitherto applied to overcome it." He further adds, "to meet this difficulty we must *increase the power*, and *decrease the resistance.*"

Mr. Mackintosh's reasoning upon this subject is perfectly correct; and I have now to state, that following out precisely the same principle, I have succeeded in contriving a balloon of entirely new description, possessing all the requisities for efficient ærial navigation, and capable of being propelled and guided at the pleasure of the æronauts. The few scientific friends to whom I have submitted my plans, have expressed themselves perfectly convinced of their feasibility, and feel satisfied that the time has now arrived when balloons will cease to be scientific toys, and assume a new and useful character.

It would not be consistent with my own personal interest, at this time, to develope the nature of my invention, but your readers will hereafter have an opportunity of becoming acquainted with it. I should wish no person to suppose for one moment that balloons will ever be guided in the teeth of opposing currents; but I am now prepared to assert, and all who have examined my scheme will support my position—that in balloons upon my construction, the power is so much increased and the resistance so

much diminished, as to enable them to be propelled and guided through the air with as much facility as boats at present are upon the surface of our river Thames.

By the same means, an upward or downward direction can be given to a balloon, without in any way varying the quantity of gas or of ballast—and the machine brought under a degree of control hardly before anticipated.

I remain, Sir, yours respectfully,

WM. BADDELEY.

Oct. 11, 1836.

From the London Mechanics' Magazine.

ON AEROSTATION.

Sir,--Having in my letter of the 1st ult. (see p. 307,) endeavored to show the improbability of aerial machines tending to any useful purpose, while they retain their present form, I shall now add a few remarks, suggesting the form in which balloons ought, in my opinion, to be made.

In art we generally imitate the works of nature; now, all animated bodies intended for locomotion in the air or water have a head and a tail; man has imitated this in the ship, which has a stem and stern; but in the balloon he has neglected his model, as at present made they have neither, and to this mal-confirmation alone must be attributed the repeated failures that have taken place in all attempts at guiding them. Upon this, I found the following observations:—

Balloons have two motions, a vertical and a horizontal; the former caused by the levity of the gas contained, and the latter by the prevailing current of air in which it ranges; and this latter is the movement that requires to be regulated, as the other can be varied by retaining or discharging of the gas or the ballast. Now, when it is considered how readily a vessel answers to her helm, and that water is to air, as 832 to 1, I cannot conceive that it would be found so difficult a task to guide an *oblong machine* in such a yielding element as atmospheric air. I am aware that many scientific persons think differently; I would call the attention of such to an account in the daily papers, not many months ago, of one of his Majesty's ships, after losing her rudder and a temporary one in a hard gale of wind of several days' duration, having been steered up the Channel to Spithead by only attending to the trimming of her sails; there are also other known modes of steering by the assistance of the wind alone. In short I am doubtful whether machines to float in the air should differ, except in the *materials* for their construction, from those used to float on the water.*

It is common with with aeronauts now to ascend to a most unnecessary height for any experimental purpose; if ascensions were confined to a moderate height, sufficient for all the ordinary purposes of voyaging, descents might generally be more safely and rapidly effected in cases of danger. With respect also to the proposed enlargement of balloons, I would ask, are not two or three persons sufficient for philosophical or experimental trials? First let the aeronauts show the capability of guiding them, and capaciousness may then follow. When announcements like those of the proprietor of the "Eagle" and her seventeen passengers are made, I augur unfavorably of their performances adding much to our stock of knowledge. Proofs of the points necessary to be first ascertained might be made for a tithe of the money that must be expended in making a balloon of the magnitude of that now about to ascend from Vauxhall; for the fate of which all thinking persons must feel some apprehensions, notwithstanding its being under the guidance of the most experienced aeronaut of the day.

I remain, Sir, yours, &c.

OMRI.

London, Sept. 4, 1836.

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*In comparing aerial with marine navigation, the fact is generally lost sight of, (as in the present instance by "Omri,") that in the latter case the vessel floats in one medium and is propelled by the help of another, whilst in the former it floats in, and is propelled by, one and the same medium.

From the Repertory of Patent Inventions.

SPECIFICATION OF THE PATENT GRANTED TO FRANCIS BREWIN, OF THE OLD KENT ROAD, IN THE COUNTY OF SURREY, TANNER, FOR CERTAIN NEW AND IMPROVED PROCESSES OF TANNING.—SEALED JANUARY 11, 1836.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Francis Brewin, do hereby declare

that the nature of my said invention, consists in the making or preparing a new liquor or liquors for tanning or manufacturing raw hides and skins into leather, and for retanning leather manufactured in the ordinary way from certain exotic substances, which have not heretofore been in use for manufacturing leather in this country, or from a combination of these substances with other materials already in common use, by means of which new liquor or liquors, leather can be manufactured of a superior quality in less time than usual, and at much less expense, and by which also leather manufactured in the ordinary way may be improved in quality. And I declare that the manner in which the said invention is to be performed, is fully shown and set forth in the following description thereof, (that is to say):

I employ in the making and preparing of the said new tanning and retanning liquor or liquors, certain substances known in English commerce by the names of gum-kino, divi-divi, and terra-japonica, all of which I find contain much larger proportions of tannen than the best English oak bark, and yield liquors, possessed respectively of the following properties:—a solution of gum-kino imparts to leather a brownish red color, but improves it considerably in point of closeness and firmness of texture; a solution of divi-divi gives a very light color to leather; a solution of terra-japonica, of the sort generally imported in small square pieces, gives a dull light color, and one of terra-japonica of the sort generally imported in large cakes, a brownish red similar to that obtained from gum-kino. A solution of divi-divi I prepare in the same way as the ordinary bark liquors are made in vats or lecks by tanners.—But gum-kino and terra-japonica require to be treated in the manner following. If the gum-kino is in large pieces, or if the terra-japonica is of the sort which is sold in large cakes, I first break these large pieces and cakes with a hammer into small pieces; I then steep the whole for about three days in cold water, or cold weak tan liquor; after which I put the whole into what I call a rubbing tub of the construction shown in the drawing in the margin hereof, for the purpose of being still further reduced; or I use hot water, or hot weak tan liquor, in which case I put the whole of the materials at once into the rubbing tub, and leave them to steep for about an hour only, which last process is that which I prefer. This tub is about five feet deep and four feet wide in every part, and has a loose cover just so much smaller to it in circumference that when not kept up by the materials in the tub, it will readily fall to the projection or stopper, fixed at about four inches from the bottom, and in this cover, on the under part thereof, about one hundred spikes of copper, wood, or any other material that will not stain the liquor, of about three inches long, are firmly inserted. A square wooden shaft, about five inches thick, with a wheel or handle at top to turn it by, is passed through an orifice of corresponding size and description in the centre of the cover, and drops into a recess in the bottom of the tub, large enough to allow the shaft to turn freely within it. The materials having stood sufficiently long for steeping, the shaft of the tub is worked round by manual or other power, which carries around with it the loose cover with the spikes underneath, till, by the stirring and rubbing action of the spikes, the pieces of the gum-kino or terra-japonica in the tub, are either successively dissolved or reduced to such small dimensions as to pass easily between the cover and the sides of the tub; and in order that the said cover may press continually downwards on the materials in the tub, and descend as the materials become dissolved or reduced to the dimensions aforesaid, a heavy weight or weights is or are placed and kept on the top thereof during the whole of the operation: and in preparing the said solutions for use I employ more or less water or weak tan liquor, according to the sort of leather which is intended to be manufactured; (that is to say,) for sole leather I use about fifty to one hundred pounds of the gum-kino, or of the divi-divi, or of the terra-japonica, with about one hundred gallons of water or weak tan liquor; and for manufacturing dressing leather, I use with every fifty to one hundred pounds of the divi-divi and light terra-japonica about three hundred gallons of water or weak tan liquor, rarely using the gun-kino or dark terra-japonica at all in the manufacture of dressing leather, or any sort of leather in respect to which color is an object; or instead of at once dissolving the said materials in the said proportional qualities of water or tan liquor, I dissolve them at first in any smaller quantities of

water or weak tan liquor, and afterwards reduce the solutions to the required strength by the addition of water or weak tanning liquor; and when I have, by the processes aforesaid, obtained the requisite solutions of gum-kino, divi-divi, light terra-japonica, and dark terra-japonica, I generally mix for sole leather the different solutions together in a common tan vat in the following proportions; (that is to say,) one quarter of the solution of gum-kino, one quarter of the solution of divi-divi, one-eighth of the solution of the dark terra-japonica, and three-eighths of the solution of the light colored terra-japonica; I then put into the liquor so prepared and compounded, about one-fourth more raw hides or skins than would in general be put by tanners, into an equal quantity of bark liquor, and with every hide I put on an average about one pound of oak bark in the same way as tanners now use bark in the vats with hides and skins. For manufacturing dressing leather, I mix the solutions of divi-divi and light terra-japonica, prepared as before mentioned, and put the hides or skins into them with the same proportions of bark and liquor as are hereinbefore directed to be used in the case of sole leather. When the leather is required to be of a very close and firm texture, and the color is a matter comparatively unimportant, I make use of a larger proportion of the liquor of gum-kino than is before directed, and when the dark terra-japonica is low in price, and when the color to be given to the articles is immaterial, I also make use of a larger quantity of that material than of any of the others; and when it is desired to have the leather of a color lighter than that which results from the combinations of all the four liquors in the proportions before recommended, I diminish the proportional quantities of the dark coloring substances according to the particular shade of color required to be given to the article. And whereas some one or more of the said articles may occasionally be so scarce in the market, or so high in price that it may not be practicable or economical to employ it or them in the quantities before recommended with the other substances, I declare that the use of any one or more of the said substances may be dispensed with either wholly or partially, but subject to the following modifications in the effects produced; (that is to say,) if gum-kino be used alone the leather produced will be too hard and close for general purposes; if divi-divi be used alone, it will produce leather lighter in color than usual; if terra-japonica be used alone, an article will be produced possessed neither of that firmness nor that color which is generally desirable in leather, while, by the addition of divi-divi to gum-kino or terra-japonica, a better article is produced than can be obtained from either gum-kino or terra-japonica separately. And whereas also the prices of all the four articles aforesaid may, at times, rise so high that, notwithstanding their superior tanning properties, they cannot with economy be entirely substituted for oak bark, or any of the other barks or tanning materials now in common use, I declare that the same may be advantageously used in combination with the said common materials in the proportions following; (that is to say,) any given quantity of gum-kino, divi-divi, and terra-japonica, mixed in the proportions before recommended, may be combined with any quantity of oak bark; or any given quantity composed of six-twelfth parts of light terra-japonica, four-twelfth parts of divi-divi, and two-twelfth parts of gum-kino may be combined with an equal quantity of mimosa bark or kermac root; or any given quantity composed of gum-kino, divi-divi, and terra-japonica, in equal proportions, may be combined with two-eighth parts of valonia, and two-eighth parts of oak bark; or, lastly, eight parts of gum-kino, divi-divi, and terra-japonica may be combined with two-eighth parts of oak bark, and one-eighth part of shumach. When gum-kino, or divi-divi, or terra-japonica, or any of them, are intended to be used along with oak or other bark, they may either be ground very small in a common bark mill, after being well dried, if not sufficiently dry for grinding in their original state, and then mixed up with the bark, or the bark and divi-divi may be steeped by themselves in the taps, and the liquor drawn off and made hot, and then put in such quantity into the rubbing tub as is necessary to dissolve the gum-kino or terra-japonica, as before described, which latter method is that which I prefer; or water or weak tan liquor alone, either hot or cold, may be used to dissolve the new materials before mixing them with the common liquors; the liquors made from these various articles I prefer using of about

the same tanning strength as those made from the new materials alone; and though the proportions in which I have hereinbefore directed the gum-kino, divi-divi, and terra-japonica to be mixed with each other, or with oak bark and others of the materials already in common use, are those which I have found to answer best under ordinary circumstances, I declare that the said proportions may be varied at the discretion of the practical tanner according as the taste of customers in respect to the color of leather may vary, or according to any particular quality desired to be given to the manufactured article, or according to the comparative cost at different times of the different materials. And I declare that for retanning or improving leather made in the ordinary way, I put it into a fresh liquor, the same as is hereinbefore directed to be used for sole leather, and after it has remained therein for one day, I handle it, I then allow it to remain in the liquor for from eight to fourteen days, after which I take it out and dry it, and, if necessary, restrike it; and I declare that what I claim as my invention is the making and preparing of a tanning liquor or liquors for tanning or for manufacturing raw hides and skins into leather, and for retanning leather manufactured in the ordinary way with gum-kino, divi-divi, and terra-japonica, either employed separately or combined with each other, or with other substances already in common use, in the different proportions, and in the manner hereinbefore specified, or in any other proportions and manner which a change of circumstances may render more suitable; and such my invention being, to the best of my knowledge and belief, never heretofore used in this country, I do hereby declare this to be my specification of the same, and that I do verily believe this my said specification doth comply in all respects fully and without reserve and disguise with the proviso in the said hereinbefore in part recited letters patent oontained; whereof I hereby claim to maintain exclusive right and privilege to my said invention.—In witness whereof, &c.

Enrolled July 11, 1836.

EXTRACTION OF SUGAR FROM INDIAN CORN; BY M. PALLAS.—The results obtained by M. Pallas are as follows:

The stalk of the corn contains little or no sugar previous to flowering.

At the time of flowering, a small quantity of sugar may be detected.

When the grain is still soft, about 20 or 25 days after flowering, the plant contains abont 1 in 100 of crystallizable sugar.

When the grain is completely ripe, the stalk furnishes two parts in 100 of sugar, and 4 in 100 of rich and good-tasting molasses.

The residae remaining after the extraction of the sugar, may be given for food to cattle, or will serve for the manufacture of wrapping paper which will bring 11 francs for 50 kilogrammes.—[L'Institut, No. 157, 1836.]

From the Journal of the Franklin Institute.

SPECIFICATION OF A PATENT FOR AN IMPROVED BOILER FOR GENERATING STEAM. GRANTED TO JOHN AMES, SPRINGFIELD, HAMPDEN COUNTY, MASSACHUSETTS, MARCH 12TH, 1836.

To all whom it may concern, be it kown, that I, John Ames, of Springfield, in the county of Hampden, and State of Massachusetts, have invented an improved boiler for the generating of steam, to be used in the drying of paper, and for other purposes, and do hereby declare that the following is a full and exact description thereof.

As this boiler is not intended to be used for steam of great elasticity, but is designed mainly, to produce it in large quantity, I intend, usually, to make it of cast-iron, although wrought iron or other metal, may be used if preferred. It may be made of various sizes, and in different shapes, but for the sake of description, I will give the dimensions of one which I have tried, and found to answer well. It consists of a box four feet square, and two feet deep, the two sides being open, but furnished with flanches for the purpose of bolting on the two plates which are to form the two sides of the stove. Tubes, forming flues, in the manner of the boilers now in general use for locomotive engines, are to pass through these side plates. In the one alluded to, the plates are cast with six rows of holes, nine in each, and about two inches in diameter. The upper row of tubes must be sufficiently below the waterline to ensure their being constantly covered; and above the water there must, of course, be sufficient space to form a steam chamber, or reservoir.

When this boiler is set, the draught from the fire place below it passes through two rows of the tubes, is returned through the next two, and finally through the upper rows. The manner of forming the flue by divisions, extending from the brick work te the sides of the boiler, between the respective pairs of rows will be readily understood by reference to the drawing which accompanies this specification.

Fig. 1.

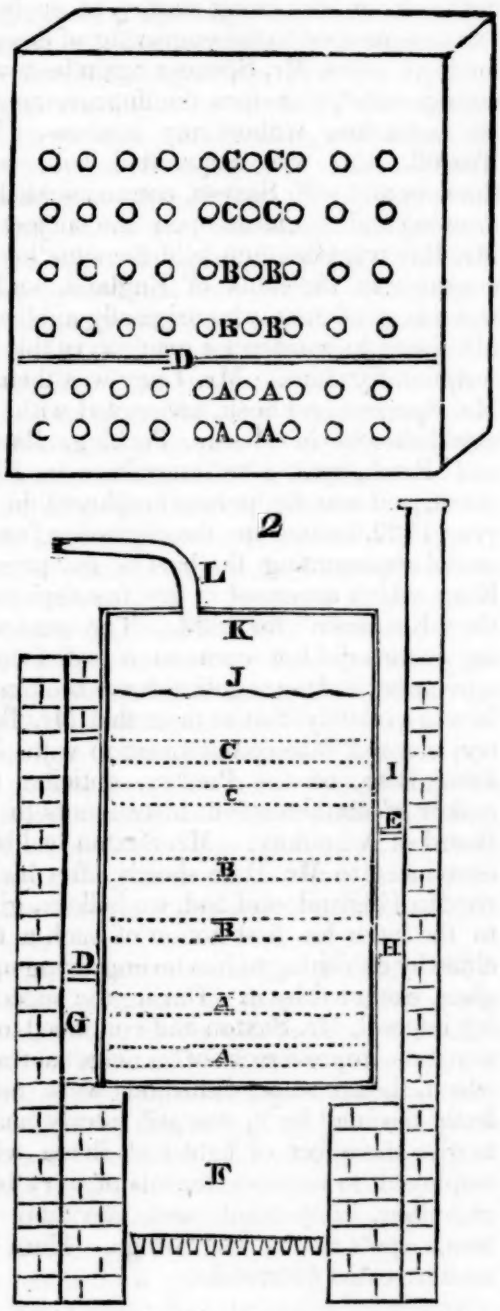

Fig. 1. is a side view of the boiler A A, B B., and C C, being the open end of the tubes through which the heated air from the furnace is to pass, as will be shown more distinctly in fig. 2. D, is one of the ledges or partitions which project out from the boiler, occupying the space between it and the masonry in which the boiler is set, and causing the draught to enter the tubes A A, in order to its returning through those marked B B.

Fig. 2. is a vertical section of the boiler and furnace, cutting the boiler from front to back. A A, B B, and C C, are the double ranges of tubes, as in fig. 1, represented by dotted lines D and E, are partitions which direct the draught through the tubes in the following manner. Let F. represent the furnace, and C, a part of the flue into which the tubes A A, open, the draught being arrested by the partition D, will pass through A A, into the flue H, and being arrested by the partition E, will return through the tubes B B, then pass those marked C C, into the flue I, leading into a smoke pipe, or chimney; J, may represent the water line, K, the steam chamber, and L, the steam pipe.

Although I kave mentioned a certain number of tubes, and have said that in the boiler which I have tried, the heated air is made to pass through the water three several times, it is manifest that the same operation may be repeated as frequently as it shall be found advantageous so to do. The number of tubes also, may be varied, and they may be placed in single rows, or otherwise, without altering the principle of action.

I have not mentioned the safety valves, cock, or other general appendages to steam boilers, as in these I do not profess to have made any improvement; nor have I described any particular manner of securing the tubes, this being well known to engineers.

A boiler thus made, is recommended by its simplicity and economy, where it is desirable to generate a large quantity of steam under a moderate pressure, as for the purposes of heating and drying in various manufacturing processes. What I claim as my invention in it, is the general combination and arrangement of the parts by which the draught from the fire is made to pass repeatedly through the water, as herein set forth, whether made in the exact form represented, or any other which is substantially the same in its construction and operation.

JOHN AMES.

From the Athenæum.

MEDALLIC ENGRAVING.

The idea of employing machinery for the purpose of engraving upon metals is not of very recent origin: as was the case with steam navigation, the principle was recognized many years before it was put into successful practice. In the year 1830, Mons. A. Collas, an able mechanician at Paris, having been commissioned by an engraver at Ghent to make a ruling machine for him, constructed one for himself, upon a somewhat different principle, with which he made several attempts to execute engravings upon copper, in the style of a pattern which had been published in the *Manuel des Tourneurs* upwards of twenty-four years before. It was not till six months' labor and thought had been bestowed upon it that M. Collas brought his invention to a certain degree of perfection: he produced his first engravings in the spring of 1831. Of the attempts at a similar instrument, made in the United States, we are informed, and believe, that he had seen or heard nothing; but in the year 1833 he chanced to meet at Paris with an old mathematician from Geneva, whose father had, some sixty years before, been employed in executing engravings by machinery upon the cases of gold and silver wathes; so that the remotest traces of this art may be dated about the year 1775 to 1780.

It has been ascertained, beyond all doubt, that this invention is not of domestic growth in England. It was in the year 1817 that a die-sinker of the name of Christian Gobrecht, then living at Philadelphia, produced by a machine an engraving upon copper of a medallic head of the Emperor Alexander of Russia, several impressions of which were distributed in that city. Mr. Asa Spencer (now of the firm Draper. Underwood, and Co.) took one of Gobrecht's machines with him to London in the year 1819, which was its first introduction into London. This machine was principally designed for straight and waved lines; it was employed in London, and its uses exhibited and explained by Mr. Spencer to several artists. It attracted the particular notice of the late Mr. Turrell, an engineer, and he obtained permission to make a drawing of the machine, for the purpose of having one constructed for his own use. Ten years afterwards, in the year 1829, Mr. Joseph Saxton, an American, born at Huntingdon, in Pennsylvania, who had known Gobercht, and seen the engraving from the Russian medal, contrived a machine somewhat similar in principle to the one brought to England by Mr. Spencer; in this he first introduced a *diagonal tracer*, for the purpose of correcting some of the defects which existed in the medallic engravings executed by Gobrecht's and Spencer's machines; these had all of them an unpleasant twist upwards, and an evident distortion of the features of the head. In the following year, an idea being started of applying this new method to the engraving of designs for bank notes, Mr. Spencer again bestowed considerable pains upon the improvement of his invention, without any success. Mr. Turrell, who was acquainted both with Spencer and with Saxton, communicated his drawing and his ideas upon the subject to Mr. Bawtry, who then held the situation of engraver to the Bank of England, and it was this gentleman who originally applied to Mr. Lacy to construct a machine of this description for him. Mr. Lacy was then, as Mr. Spencer had been, connected with the establishment of Messrs. Perking, Bacon, and Petch, bank note engravers in Fleet street, and was the person employed, in the year 1832, to execute the engraving from a medal representing the bust of our present King, which appeared in the frontispiece of the "Keepsake" for 1833. The contracting parties did not come to a satisfactory agreement, and the negotiation was broken off. It was probably that at time that Mr. Bawtry entered into communication with Mr. John Bate, of the Poultry, optician and maker of mathematical instruments to the Board of Admiralty. Mr. Saxton had been introduced to Mr. Bate shortly after his arrival in England, and had, we believe, given to the latter his first notion of such a machine by exhibiting to him an engraving upon glass, executed by it. During the succeeding interval, Mr. Saxton had continued to attempt the improvement of his diagonal tracer which, though some distortions were manifestly obviated by it, was still utterly unable to give the effect of light and shade when employed to engrave medals of very bold, or, rather, *steep* relief, and inevitably left blank spots in the engravings. Here the matter rested for awhile.

In the earlier part of the year 1832, the Messrs. Bate having been informed that Mr. Saxton had effected several improvements

in his machine, had an interview with him, for the purpose of exchanging their ideas upon the subject. But a natural feeling of jealousy prevented either party from exhibiting to the other his machine; the Messrs. Bate stated, indeed, that they had succeeded in removing the distortions which existed in their earlier productions; Mr. Saxton, on the other hand, referred to his own invention, and declared himself capable of executing by his machine as much as they could do by theirs; finally agreeing to satisfy them of the truth of his assertions, by putting into their hands an engraving, in which all distortions should be avoided. This engraving was a head of Franklin, with a bust of Minerva copied from a gem or cameo. Upon examining it the Messrs. Bate, however, seemed to think that some distortions, though slight ones, still remained. It was then proposed that both parties should execute an engraving from a gem representing the head of Ariadne, an impression of which, in wax, Mr. Bate, junior, undertook to send to Mr. Saxton. But here the matter ended —the wax impression was never sent, and two months afterwards Mr. Saxton was informed that Mr. Bate had taken out a patent for an improved machine, particularly specifying the introduction of the diagonal tracer, which happened to be the same as his own. Mr. Saxton, disgusted with the turn which matters had taken, turned his attention to other mechanical inventions, and subsequently sold his machine to Mr. W. Trevylian, in whose hands it now remains. From that period nothing was done in the way of engraving from medals, and no step taken, either by Mr. Bate himself, or his friends, to bring his invention before the public; the invention, as it were, remained dormant in England.

It was towards the close of the year 1832 that M. Collas sold his patent to a few gentlemen, who, with the aid, and under the direction of some of the first French painters. sculptors, and engravers, united themselves in a company, under the firm of Lachevardiere and Co. It is to the enterprising spirit of these gentlemen that we are indebted for the "Tresor Numismatique et de Glyptique" (see *Athenæum*, No. 388, p. 261), which has now reached the extent of 600 plates of medals, bas reliefs, &c., representing upwards of 5000 subjects. This work has been widely circulated in France and throughout the continent: most of its plates, for beauty of effect and artist-like execution, leave the eye nothing to desire. It is needless to remind our readers, that the French company, just mentioned, has for some months been actively bestirring itself, for the purpose of applying the invention of M. Collas to the illustration of our medallic history; and that a petition for the assistance and patronage of government to such a national work was laid before a Committee of the House of Commons during the recent session. These efforts have been met by a determined opposition on the part of certain of our native artists, who have attempted to quench the scheme, by bringing forward Mr. Bate's almost forgotten invention, in proof that the ground was pre-occupied, and by denouncing the French engravings as false, distorted, and mathematically inaccurate. In answer to the first plea, it is enough to state the fact, that nothing was done by Mr. Bate in the way of making his invention popular—no plan thought of, of applying it to a grand national undertaking—till the French company, with a superb work to point to as a specimen of *what their machine had effected*, laid their proposals and petition for Parliament. The second argument, a charge of mechanical inaccuracy brought against the French engravings, will be disposed of with equal ease, though not quite so briefly.

It will be admitted, without hesitation, that the best representation of any subject, as a work of art, is the one which shall convey the most faithful and pleasing impression of its general effect; that, as the said representation is to be judged of by a pair of eyes, and not by a pair of compasses, there are cases wherin the latter may *prove* a mathematical incorrectness, which the former will not acknowledge, and which, therefore, in no respect, impairs the merit of the copy. In examining a medal, *if it be laid flat upon a table*, all the effects of light and shade will disappear, and its bold outlines only strike the eye; whereas, *if it be taken up in the hand*, the relief becomes apparent, and the design is set off with the powerful aid of *chiaro-scuro*. The professed medallist may possibly prefer the first mode, as the best means of obtaining the exact proportions of the work before him; the general amateur and artist will assuredly give preference to the medal as seen in relief, being the more characteristic and pleasing aspect. It is to the faithful rendering of the latter effect, that the attention of the French engravers

has principally been directed, at the necessary expense, in some cases, of geometrical exactness. A complaint, therefore, has been raised against their works, as unfaithful—they have been proved guilty of incorrectness, by the compasses, and the harsh word "distortion" has been liberally applied to them. But we are persuaded, that the weight of the objection is merely in the harshness of the word: the result of a careful examination of many specimens laid before us, has convinced us that there is no defect in the works executed by the French machine; there may, indeed, be occasional deficiency, inasmuch as, while the machine cannot give any thing but what is on the medal, it may not, in every instance, give *all* that is there. Granting, then, that the general effect of the medal, when held in the hand (that is, when seen in *chiaro-scuro*,) be faithfully and artistically rendered by the French machine, it is fruitless to *reason* about an imperfection, of which the compasses, and not the eye, are sensible. It should further be insisted upon, that this "incorrectness" with which the works of the French machine have been charged, is not necessary to it, but has been merely sanctioned for the sake of effect by the presiding artists, on the principle just laid down. Besides other engravings of geometrical exactness already produced, a plate is in preparation containing the Soane medal, the head of Henry the Fourth, the Ariadne, and other subjects, by which the proprietors are prepared to prove that the style of execution which they have adopted has been a matter of choice, and not enforced upon him by any defect in the machine.

The universal approbation given to the engravings of the "Tresor" by the artists and amateurs of the continent, who do not undervalue scrupulosity of outline and precision of drawing, may be quoted in support of the line of argument we have adopted: we may also, in confirmation, select a few passages from the evidence given before the Committee of the House of Commons upon the subject. Sir Francis Chantrey, when asked whether the mathematical inaccuracy objected to "produced an idea of distortion or any disagreeable effect to the eye," answered, that "it never produced any disagreeable effect to his eye, nor was he aware of it till it was pointed out to him;" and, therefore, he considered it of no very essential importance, and expressed his unqualified satisfaction in the engravings produced by the French machine. Mr. Hawkins, of the British Museum, when asked a similar question, gave a similar answer; he said that "a deviation, which is not visible to the eye, is not to be considered as a distortion;" and pronounced M. Collas's method as "giving the best idea of the medal of any method he had seen." Mr. Pistrucci, of the Mint, when examined before the Committee as to the merits of the French and English machines, gave it as his opinion, "that both are very clever, but each of them is deficient in that which makes the chief merit of the other: the French machine is beautiful and admirable for effect, and gives a correct idea of the work; but in a perspective view, or what I may call more appropriately foreshortening, it does not give the objects precisely as we see them, when we look at the centre of a real medal, but in chiaro-scuro, and with much effect. The English one gives it straight as far as I can judge: but I cannot say that it is mathematically correct with the original, not having had the original medal before me to compare it with; and it is possible that there may be a difference in the height, though not in the breadth of the objects rendered; but the engraving is flat and hard, with little or no effect."

We think that the above will suffice to convince our readers that the objections raised against the engravings produced by M. Collas's machine, are frivolous and futile. It is needless for us to repeat once again our opinions with respect to the feasibility and interest of the national work proposed; and if those who have any doubts on the subject, will examine the magnificent engravings of the portrait of Louis Phillppe, and the one from the bas-relief of the Canterbury Pilgrimage, we think they will be, like ourselves, fully satisfied that such a work could not be in better hands than those of M. Collas and his enterprising coadjutors. We have now only to describe the specimens:—

No. 1. Innocence prostrating herself before Justice, and entreating her protection; Violence is represented by a warrior holding a naked sword.—Sauvage.

2. Part of the Phygalian Frieze.

3. Cupid and Psyche; from a cameo by Louis Pikler, after a bas-relief by Thorwaldsen.

4. Vulcan forging the shafts of Cupid;

from a cameo by Pikler, after a picture by Raffael Mengs.

5. Antigone and Ismena before the Temple of the Furies, urging Œdipus to return to Thebes; from a cameo in onyx by Louis Pikler.

6. The Heads of Augustus and Livia; from an ancient cameo in sardonyx.

7. Hercules stifling the Nemæan Lion; from a sculpture in bronze of the 15th century.*

* With every respect for our esteemed contemporary, we must say, that if the capabilities of M. Collas's machine are to be judged of from the specimens here referred to, its superiority is extremely questionable. The utmost that in our humble opinion, can be fairly said of them as works of art is, that they are striking and curious—considering how they have been produced—not that they are in themselves remarkable either for truth of delineation or excellence of finish. We have seen much better specimens of the art, both English and American.—Ed. M. M.

From the London Mechanics' Magazine.

So much has been said of Mr. Crosse and his experiments in electricity, that any information of his *modus operandi* will be eagerly received. The following peep into his labratory will be found highly interesting. The grandeur of the scale upon which he operates cannot fail to strike us with wonder.

MR. CROSSE'S GALVANIC AND ELECTRICAL APPARATUS.

In the *Brighton Herald* of Sept. 24, appeared, "An account of Sir Richard Phillips's visit to Andrew Crosse, Esq, of Broomfield, in the Quantock Hills, Somersetsbire, in September, 1836." Passing over a great deal of Sir Richard's preliminary twaddle (who, it will be seen, claims to have anticipated Mr. Crosse), we now lay before our readers his description of the extensive and splendid galvanic and electrical apparatus fitted up by Mr. Crosse, which is exceedingly interesting:—

"On reaching the handsome mansion of Mr. Crosse, I was received with much politeness, and found that I was the first visitor from Bristol. After breakfast, Mr. Crosse conducted me into a large and lofty apartment, built for a music-room, with a capital organ in the gallery; but I could look at nothing but the seven or eight tables which filled the area of the room, covered with extensive Voltoic batteries of all forms, sizes, and extents. They resembled battalions of soldiers in exact rank and file, and seemed innumerable.

"They were in many forms. Some in porcelain troughs of the usual construction; some like the *couronnes des tasses;* others cylindrical; some in pairs of glass vessels, with double metallic cylinders; besides them, others of glass jars, with stripes of copper and zinc. Altogether, there were 500 Voltaic pairs at work in this great room; and in other rooms about 500 more. There were besides another 500 ready for new experiments. It seemed like a great magazine for Voltaic purposes.

"There are also two large workshops, with furnaces, tools, and implements of all descriptions, as much as would load two or three wagons.

"In the great room there is also a very large electrical machine, with a 20 inch cylinder, and a smaller one; and in several cases all the apparatus in perfect condition, as described in the best books on electricity. The prime-conductor stood on glass legs, 2 feet high; and there was a medical discharger on a glass leg of 5 feet. Nothing could be in finer order; and no private electrician in the world could, perhaps, show a greater variety both for experiments and amusement.

"Beneath the mahogany cover of a table, on which stood the prime conductor, &c., was enclosed a magnificent battery of 50 jars, combining 73 square feet of coating. Its construction, by Cuthbertson, was in all respects most perfect. To charge it required 250 vigorous turns of the wheel; and its discharge made a report as loud as a blunderbuss. It fuses and disperses wires of various metals; and the walls of the apartment are covered with framed impressions of the radiations from the explosion, taken at sundry periods. Mr. Crosse struck one while I was present; and he has promised me one as an electrical curiosity, and a memento of my visit.

"But Mr. Crosse's greatest electrical curiosity was his apparatus for measuring, collecting, and operating with atmospheric electricity. He collects it by wires the sixteenth of an inch, extended from elevated poles, or from trees to trees, in his grounds and park. The wires are insulat-

ed by means of glass tubes, well contrived for the purpose. At present he has about one-fourth of a mile of wire spread abroad; and in general about one-third of a mile. A French gentleman had reported to the Section at Bristol, that the wires extended 20 miles, filling the entire neighborhood with thunder and lightning, to the great terror of the peasantry, who in consequence left Mr. Crosse in the free enjoyment of his game and rabbits. This exaggeration Mr. Crosse laughed at most heartily, though he acknowledged that he knew that no small terror prevailed in regard to him and his experiments.

"The wires are connected with an apparatus in a window of his organ-gallery, which may be detached at pleasure, when too violent, by simply turning an insulated lever; but in moderate strength it may be conducted to a ball suspended over the great battery, which connected is charged rapidly, and is then discharged by means of an universal discharger. He told me that sometimes the current was so great as to charge and discharge the great battery 20 times in a minute, with reports as loud as cannon; which, being continuous, were so terrible to strangers that they always fled, while every one expected the destruction of himself and premises. He was, however, he said, used to it, and knew how to manage and control it; but when it got into a passion, he coolly, turned his insulating lever, and conducted the lightning into the ground. It was a damp day, and we regretted that our courage could not be put to the test.

"Every thing about this part of Mr. Crosse's apparatus is perfect, and much of it his own contrivance, for he is clever in all mechanical arrangements, and has been unwearied in his application, almost night and day, for thirty years past. I learned, too, that in the purchase and fitting up of his apparatus he has expended nearly 3000*l.* although in most cases he is his own manipulator, carpenter, smith, coppersmith, &c.

"About 12, Professor Sedgwick arrived, and in the afternoon one or two others, besides seven or eight gentlemen of the neighborhood, who had been invited to meet us at dinner, for Mr. Crosse unites to the rank of esquire that of a county magistrate, in the duties of which he is respected alike for his humanity to the poor and for his liberal opinions in politics. Mr. Crosse himself was educated at Oxford; and his second son holds the living of Broomfield. He is master of all his father's experiments; and, in spite of the complaints of an Oxford education, I found him to be a very expert mathematician, well read, and variously accomplished. We next morning renewed our survey, previous to fresh arrivals, and I took notes of every thing connected with his aqueous Voltaic batteries, in the following order, errors excepted:—

"1. A battery of 100 pairs of 25 square inches, charged, like all the rest, with water, operating on cups containing 1oz. of carbonate of barytes and powdered sulphate of alumine; intended to form sulphate of barytes at the positive pole, and crystals of alumine at the negative.

"2. A battery of 11 cylindrical pairs, 12 inches by 4. This, by operating six months on fluat of silver, had produced large hexahedral crystals at the negative pole, and crystals of silica and chalcedony at the positive.

"3. A battery of 100 pairs, of 4 square inches, operating on slate 832, and platina 3, to produce hexagonal crystals at the positive pole.

"4. A battery of 100 pairs, 5 inches square, operating on nitrate of silver and copper, to produce malachite at the positive pole; a. the negative pole crystals already appear with decided angles and facets.

"5. A battery of 16 pairs, of 2 inches, in small glass jars, acting on a weak solution of nitrate of silver, and already producing a compact negatation of native silver.

"6. A battery (esteemed his best) of 813 pairs, 5 inches, insulated on glass plates on deal bars, coated with cement, and so slightly oxydated by water as to require cleaning but once or twice a year by pumping on them. I felt the effect of 458 pairs, in careless order and imperfectly liquidated, and they gave only some tinglings of the fingers; but this power in a few weeks produces decided effects.

"7. A battery of 12 pairs, 25 inches zinc and 36 copper, charged two months before with water, and acting on a solution of nitrate of silver, poured on green-bottle glass coarsely powdered. It had already

produced a negatation of silver at the positive pole.

"8. A battery of 159 galley-pots, with semi-circular plates of $1\frac{1}{4}$ inch radius, placed on glass plates, and acting five months through a small piece of Bridgewater porous brick, on a solution of silex and potash. I saw at the poles small crystals of quartz.

"9. A battery of 30 pairs, similar to No. 8, acting since 27th July on a mixture, in a mortor of sulphate of lead, of white oxide of antimony, and sulphate of copper, and green sulphate of iron (205 grains), and three times the whole of green-bottle glass (615 grains). The result has been, in five weeks, a precipitation on the negative wire of pure copper in two days, and crystallised iron pyrites in four days. It had been expected to produce sulphurets of lead, copper, and antimony, by depriving the sulphates of their oxygen. On August 10th and 28th, 25 grains and 40 grains of sulphate of iron were added.

"10. A battery of 5 jars, with plates of different metals, as 2 copper and platina, 1 lead and lead, 1 silver and iron, and 1 copper and lead. Experimental.

"11, 12, and 13. About 200 pairs, in 3 batteries, working in a dark room, of which I took no note.

"While I was an inmate with Mr. Crosse, we had various conversations about the power which he employed. I had in some degree anticipated his *debut*, by hazarding, in the last edition of my 'Million of Facts, (1835), an assertion that, inasmuch as metals are found only in a mixed or confused state of different rocks, among which a galvanic action on air or water would necessarily arise, and in long time generate the compound or matrices of metals; but I did not regard this public anticipation as any interference with his original merits, and I was deeply penetrated by the view of his labors and the expense and zeal with which he had prosecuted his experiments. Yet he had a round conductor for a minimum of power, instead of a combination of flat or parallel ones for a maximum. And he could not help talking about the fluid and some other fancies of the elder electricians, who invented their doctrines before it was suspected that air was a compound, and that such active powers as oxygen, nitrogen, hydrogen, and their definite numerical co-mixtures, conferred mechanical character on the most refined operations of nature.

"He instructed me in the fact, that his batteries performed four times the duty in those hours in the morning, from seven to eleven, when the great laboratory of nature is envolving the most oxygen—than in the same period in the evening, when we may imagine the contrary effect takes place. He considered the air as so non-electric in damp weather, that no plate of air lying between the coating of a cloud and the earth could then be disturbed; and he stated to me, as a general fact, that the earth is always positively electrified.

"On my part, I enlarged to him and his son on the universality of matter and motion in producing all material phenomena, independently of the whimsical powers invented in ages when we would have been burnt for a magician; and in this way I endeavored to return the various information which he had unrservedly imparted to me. I impressed on him, that all this creative energy of atoms was merely a display of developements by the great motions of the earth as they affect the excitable parts of different solid bodies; the results of which are necessarily regular, and their ultimate laws of re-action and combination also regular, so as to produce that universal harmony which surprises beings, who in eternal time live and observe within only a unit of time. Hence that terrestrial galvanism, arising from the operations of the internal frictions and varied pressures called heat; hence those factitious productions of metallic matrices and crystalline galvanic effects, where different substances are proximately opposed; hence magnetism itself, tangentally displayed as a resultant of terrestrial currents of electricity; hence the fluctuations of the phenomena from obliquity of the axis of rotation, which in regard to the axis of the orbit generates two variable directions of massive pressure; hence, in fine, the wisdom displayed by Mr. Crosse in resorting to the *modus operandi* of Nature in his attempts to imitate her most curious productions.

"Observing that continual fresh arrivals rendered it ineligible for me to prolong my visit, I proceeded to Taunton, a distance of

six or seven miles, the nearest place at which a stranger can meet with public accommodation."

WATER-TANKS.

At the late meeting of the Cornwall Polytechnic Society, a description was given of nine tanks, which had proved eminently useful during the late three dry summers on the Sussex property of Davies Gilbert, Esq., the President of the Society. As these tanks are cheaply and easily constructed, and not liable to decay like wooden vessels, and as rain enough falls on every house in England for the use of its inhabitants, no family would be deficient in good soft water who made a tank to *retain* it; and such tanks being paved over, take up no room.

The tanks at East Bourn vary in size: one of less than seven feet deep and wide has served two laborers' families for three years; whilst most of the springs in the neighborhood were dry.

A tank 12 feet by 7 had supplied with water a large family and six horses. This was surrounded by only 4½ inch brick-work resting solid against the sides, in consequence of being smaller at the bottom than higher up; and the dome is constructed on the Egyptian plan, by projecting horrizontally each row of materials one-third of their length beyond those below, and filling up the back with earth as it proceeded, to balance the weight of this projecting masonry.

At the East Bourn Workhouse for fourteen parishes, a tank has been made, 23 feet deep by 11 wide, of the roughest materials, being only flint stones, and though they require more mortar than if they had been regularly shaped, only 90 bushels of lime were allowed, including two coats of plaster, and the workmanship is executed like field walls at 10s. per 100 square feet; the only essential being, that *no* clay be used (which worms bore *through*,) and that the lime or Parker's cement be good.

A current of air is said to promote the purity of water in tanks, and this is easily effected by the earthenware or other pipe which conveys the rain from the roof, being six or eight inches in diameter, and an opening left for the surplus water to run away; and where the prevailing winds do not blow soot and leaves *on* the house, the water remains good, even for drinking, without clearing out the rubbish more than once a year; but in some cases filtering by ascension may be found useful, and be effected by the water being delivered by the pipe at the bottom of a cask or other vessel from which it cannot escape till it has risen through the holes in a board covered with pebbles, sand, or powdered charcoal.

Upwards of twenty laborers' gardens have been watered by the rain which formerly injured the public road, and was therefore turned into a sink well, which sink well was enlarged and surrounded by 9-inch masonry, and the water is drawn up by a *cast-iron curb*. This water was used in planting potatoes, and occasioned good crops in 1835, when setts not watered failed. And, should the profitable mode of *stall-feeding* now practised at Armagh be happily extended to England, and fatting oxen be kept *in pairs not tied up under shelter*, it will be found that preserving in tanks the water which falls on the barns and stalls will amply supply them, whilst it prevents the rain washing away the strength of the manure when straw is spread in the open yard.

Ponds have been made with equal success, dug 4½ feet only below the surface, what is excavated being added to the sides, and covered one foot thick like a road with pebbles and good lime mortar. Such ponds are become general on the dry soil of the South Downs for the use of the large flocks of sheep: and had such ponds been made in Romney Marsh, &c., during the late dry years, the sheep would not have died in such numbers as materially raised the price of meat in London.—[Bath and Cheltenham Gazette.]

From the London Mechanics' Magazine.

TUNNEL UNDER THE NIAGARA.

Sir,—I perceive in some former Number of your Magazine, you have related an account of a proposed tunnel under the Ohio river at Cincinnati; your correspondent does not state that the bed of the river there, is a limestone rock, and the huge building of immense thickness, and nine or eleven stories high in the water, stands on the rock, and all the stone to build it was procured from the bed of the river at low water. However, I am not going to relate any thing of the difficulties of that affair; my business is to suggest to your readers, and all others whom it may concern, that the greatest, best, and most magnificent tunnel in the world, would be in Canada, under the river Niagara, at the

rapids of Fort Erie, opposite Buffalo in the United States; I say the best, and the easiest made, for the Niagara river there is narrowest, and its bottom is a flat, hard rock, which is a natural shield of itself, and below it a softer rock, which is easily cut. Captain B. Hall, in his "Travels" in America, has particularly described the strata a little lower down at the falls.

Now, if Brother Jonathan would agree to meet us half way, the thing, though of so great magnitude, would be easier performed than any thing of the kind in any other part of the world. The only attention required would be to plug up with clay any fissures in the rock which might occur, and cement them over. No great depth is required; the water seems as shallow there as at the falls on the same rock. All Lake Erie is on a complete bed of rock, and so level that an anchor slides along hundreds of yards at a time without holding. The whole is particularly suitable for such a purpose; and whenever done (if ever done,) your publication will have the honor of first pointing out to the public its true nature.

Your constant well-wisher,

A Traveller.

Wilden, Sept. 30, 1836.

From the London Mechanics' Magazine.

MANUMOTIVE- CARRIAGES.

We have often wondered that in these inventive days, no one has perfected an apparatus similar in design to the one inquired for in the following communication—Cannot our ingenuity supply this trantsatlantic want?

Sir,—By the extract in your last number from a Dublin paper, we learn that a whitesmith of Enniscorthy is emyloyed, as several other persons at this time are, in constructing a manumotive-carriage. In the present instance the vehicle "is propelled by an iron handle, which the guide moves to and fro with the right hand."

One would think it was almost impossible to hit upon any scheme for this purpose possessing much novelty, so many and so various are the plans that have been tried. When *velocipedes* were so much the rage in London a few years since, much ingenuity was exercised to produce manumotive-carriages in which the softer sex might ride; but without success, and since that time this has been the favorite hobby of many individuals. It is unfortunately a fact, that too many persons are apt to imagine, that the success of their machine depends upon the quantity and complexity of the mechanism employed, and this mistake generally proves fatal to their success.

When discussing this matter in a previous number (635,) I stated that the simplest, and therefore of necessity the best way of constructing manumotive-carriages, was to "fix a spur-wheel on the axle of the propelling-wheels, and drive them by a pinion duly proportioned to the inverse quantities of time and power. The man's labor applied tothe pinion by means of a winch-handle, would produce all the effect to be derived from such a source, and more than could possibly be obtained by any more complicated train of mechanism."

By applying the manual power to two cranks placed on the axle of the pinion, but opposite to each other, working the one with the right hand and the other with the left, the greatest possible effect would be produced. The guiding could easily be managed with the feet. By a machine so formed, favored with all the advantages of the best workmanship, a person might propel himself at a tolerable good speed; but for any great distance, I apprehend it might be walked over in about the same time with less bodily exertion, and therefore with greater ease.

There are cases, however, where persons have not the free use of their legs, while thier arms retain all their wonted vigor; to such parties a machine of this kind would be of infinite service. It is desirable, therefore, to put those persons in the right road who are wishing to construct such a machine.

In the case of Mr. Nicholson, he appears to be adopting the plan, familiar to the inhabitants of this metropolis, from its having been frequently seen in our streets; a carriage was constructed, and propelled at the rate of five or six miles an hour by six men, who each pulled a lever "*to and fro*" with a motion very similar to rowing, which acting upon cranks placed on the axle of the driving-wheels, turned them round and thereby urged the carriage forward. The conversion of rectilinear into circular motion, in this case, is attended with a

great waste of power, and the plan I have pointed out would in practice be found more convenient as wellas much more efficient.

There are cases, as I have already stated, in which manumotive vehicles would prove eminently useful; in general, however, to persons in full possession of all their natural powers, the *marrowbone* stage will be the best conveyance.

Yours respectfully,

WM. BADDELEY.

LONDON, Oct. 4, 1836.

From the London Mechanics' Magazine.

ANOTHER DISCOVERER OF A MODE OF PROPELLING AND DIRECTING BALLOONS.

An Italian gentleman, Signor Leonardo Andervolti, of Spilinbergo, in the Friuli, informs us that he has invented an ærial locomotive balloon, capable of propulsion and direction at pleasure, with safety and precision, either with or against the wind. He has constructed, he says, a working model of this machine, with which he has actually traversed the air in his own country. He offers, if a certain sum of money be guaranteed to him in the event of his succeeding (of which he entertains no doubts,) to fly over to England in his balloon!—Or that he will at his own expense construct a balloon here, which shall be able to keep up a regular traffic between any two points at a reasonable distance from each other, with even greater rapidity than any steamboat or coach! The Signor does not ask a farthing until he has performed the foregoing conditions; but as his mechanism is so simple, that as soon as constructed it would be copied, and he might thereby lose the fruits of his ingenuity, he requires that a certain sum should be guarateed him before doing so, either by a company or individuals, to whom he would assign his invention secured by patent. Signor Andervolti has left his address at our office.

The Signor speaks very fair; and as he asks nothing until he fulfils the conditions above stated, there could be no risk incurred were a number of individuals to subsbribe for a hundred pounds or so each to secure so grand in invention. Of the thing itself we do not profess to give an opinion,—we know no more of it than what is stated above.

PENNSYLVANIA COLLEGE OF MINES.

We perceive that on Tuesday, Mr. Trego, one of our city delegation, gave notice in the House of Representatives, that he should next day ask leave to bring in a bill entitled "An Act for the Establishment of a College of Mines in the State of Pennsylvania."

It is understood that this bill will provide for the erection of an institution in which, in connexion with other useful and practical sciences, will be taught:

1. Geology, Mineralogy and Chemistry, as applicable to agriculture, architecture, the construction of canals and roads, the digging and boring for water, &c.

2. Mineralogical Chemistry, exemplifying theoretically and practically the most approved and economical methods of analyzing ores, earths, soils, mineral waters, &c.

3. The theory and practice of Mining, with reference to the geographical and geological position of the mineral beds and veins, and the discovery and discrimination of minerals in rocks and soils; also, the practice of engineering, as applied to mining.

4. Metallurgy, theoretical and practical, or the art of reducing and smelting ores, and of separating them from foreign matter as well as from one another; also, the mode of making the best combinations and alloys of metals used in the arts.

It is also intended to establish in the said college, a collection of specimens of all the important rock, formations and of all the minerals found in the State, properly and scientifically arranged, with their names and localities; and also a description of their chemical character, composition and their use in the arts. Also a similar collection of all useful or curious foreign minerals, with their names, uses, &c., together with such information relative to them as will be calculated to lead to their discovery in the State of Pennsylvania.

Instead of an endowment to this college from the State treasury, it is proposed to appropriate, in aid of its funds, the State tax on the dividends of coal and mining companies, and companies for the manufacture of iron, incorporated within this commonwealth which, with the aid of subscriptions and donations from liberal and

public spirited citizens, will, it is believed, be amply sufficient for the support of the college.

It is gratifying to us thus to notice the labors of Mr. Trego. Last year he introduced, and, aided by his colleagues, carried through the House, a bill directing a geological and mineralogical survey of the State. The proposed "College of Mines" seems to be most consonant with the capabilities of our State, and if rightly conducted, cannot fail to bring out its immense mineral treasures, and make them contribute to general as well as individual prosperity.—[U. S. Gazette.]

FIRST REPORT OF THE DIRECTORS OF THE EASTERN COUNTIES RAILWAY.

(Read on the First General Meeting held at the London Tavern, 26th September, 1836.)

The Act for incorporation of this company received the Royal assent on the 4th of July last, and by one of its provisions, the first general meeting of the share holders is appointed to be held within *six* months after the passing of the act; but the directors, feeling persuaded that the sooner they could make officially known to the proprietary and the public the actual state and prospects of the undertaking, the sooner it would attain that high place which it is entitled to hold in public estimation, have called this meeting within less than *three* months from the date of the act; on the earliest day, in fact, which the time unavoidably occupied in organizing the establishment of the company, and in auditing the expenses incurred in its formation, could possibly allow.

Nearly three years have now elapsed since the design of the Eastern Counties Railway was first given to the public, and several preliminary surveys made; but it is not more than ten months since it can be said to have taken any considerable hold on the public mind. The month of October last was far advanced before a Provisional Committee of sufficient weight was formed for the prosecution of the undertaking, and there then remained but six weeks within which to make all the necessary preparations previous to going to Parliament in the ensuing session. Within this brief space, the whole line of a hundred and twenty-six miles, the longest that is yet in progress in any part of the kingdom, had to be surveyed, and the maps and sections, required by the forms of Parliament, prepared: the whole of the owners and occupiers too, for a breadth of half a mile, had to be canvassed for their assents, that extreme breadth being taken in order to allow ample scope for such alterations as circumstances might afterwards render expedient. Even when the requisite plans, sections, and books of reference, had by extreordinary exertions on the part of the engineers and their assistants,—exertions which the directors honestly believe to be without a parallel in the history of such undertakings—been deposited in due time, there yet remained much to be done in order to obtain for the undertaking an adequate share of public confidence. Early in November, the chairman and two other members of the Provisional Committee had made a progress through Essex, Suffolk, and Norfolk, for the purpose of personally representing to the leading gentlemen of these counties the claims which the undertaking had to their countenance and support: and also of calling public meetings of the inhabitants to investigate and decide on its merits and the demonstrations of local approbation which this deputation were the means of eliciting, were so numerous and decisive, as to leave the committee in no doubt that they had the hearty concurrence of the counties in their endeavors to carry out the plan to a successful conclusion. But though the good will the counties had certainly been conciliated, the confidence of the monied interests of the country, from whom alone could be expected the bulk of the large capital required for its execution (the largest subscribed during the past year for any railway project,) had still to be gained. The various steps taken to this end, the directors need not stop to detail; it may suffice to state that, by the choice of active and judicious agents, and without having recourse to any adventitious aids to stimulate the spirit of adventure—by simply making known, far and wide, the sterling merits of the undertaking—the greater part of the capital was subscribed before the second reading of the bill. In point of *numbers*, the shareholders residing in, or connected with, the counties themselves, bore a fair proportion to those having no local inter-

est in the line; but the amount of capital subscribed for by them was little more than one-twelfth of the whole. Without the powerful assistance, therefore, derived from other and distant parts—from Manchester, Bristol, Bath, Edinburg, Glasgow, Dublin, and, above all, from Liverpool, the opulent and intelligent citizens of which, ever foremost in the encouragement of great enterprizes, at once subscribed for upwards of 12,000 shares of the company's stock; it may with perfect truth be said, that the undertaking must have fallen (for the present at least) to the ground.

Notwithstanding the success which had so far crowned their exertions, the directors were still but in the midst of their difficulties. A parliamentary opposition had yet to be encountered—an opposition, as it happened, of a more than usually obstinate character. there were two rival lines in the field, both of a more recent suggestion than the Eastern Counties Railway, neither of them well suited to the wants of these counties, but both, nevertheless, very respectably supported. There was also a formidable array of dinsenting owners and occupiers, headed by gentlemen of great parliamentary influence, and to all appearance irreconcileably opposed to the undertaking

It was under these circumstances, with no ordinary anxiety, that the directors proceeded before Parliament, and by no ordinary exertions that they were enabled to maintain their ground there, against the serious opposition with which they were met. The second reading of the bill in the House of Commons was not carried without a division; and in the committee, to which it was referred, were several of the most active members of that minority who voted for throwing it out. So strong, however, was the case proved in evidence for the bill, and in so conciliatory a spirit were the opposing parties met and arranged without of doors, that in a short time all opposition was at an end, and the committee unanimously agreed to a report to the House in favor of the measure, which concludes in the following highly recommendatory terms:—

"Your committee think it right to add that, according to the evidence adduced, the Eastern Counties Railway, between the termini, would traverse the most populous and most cultivated parts of the counties through which it is intended to be carried, and that great benefit would be given to the trade and agriculture by its adoption."

After the bill had passed the Commons, several new and powerful opponents sprung up; but the directors, by meeting the parties with the same promptness, and in the same fair spirit, which had carried them successfully through their previous negotiations, effected amicable arrangements with them also, and the bill was finally passed by the House of Lords, as one, which was now on all hands allowed to have for its object, the accomplishment of a measure of great public utility.

The directors, in giving this brief history of the undertaking, would have been disposed to dwell less on the difficulties they have had to encounter and have overcome, could they by a more reserved course have equally well justified to their constituency the price at which success has been purchased.

The shareholders will see, in the expedition with which the Parliamentary plans, sections, and books of reference were executed—in the more than usual breadth of country which was surveyed—in the great number of persons that it was requisite to employ for that purpose, at a time when hands for employment of this description were scarce, and their terms of renumeration proportionally high—in the numerous agencies which had to be put in motion in order to raise so large an amount of capital—in the many opponents who had to be negotiated and arranged with—and in the very short period within which nearly the whole of these things were transacted;—the shareholders will see in all this, reasons sufficient for anticipating a much larger amount of expenditure than would, under less extraordinary circumstances, have certainly sufficed.

As it is, however, the directors believe that, compared with other railway contests, this will not be found to have been more costly than usual; and instead of having occasion to bespeak your patience for an exhausted exchequer, they are happy to announce that, large as their expenditure has been, that they have still in hand a large and unencumbered balance.

From the balance-sheet annexed it will be seen that the the total receipts of the Company up to the present date amount to 61,845*l.* 2*s.* 9*d.* The claims brought against the company have, by careful revis-

ion of these claims, and allowances conceded for prompt payment, been reduced by 2,383*l.*; making the net amount of the expenditure, 36,561*l.* 19*s.* 2*d.*; deducting which from the monies received (61,845*l.* 2*s.* 9*d.*) the balance remaining in hand is 25,845*l.* 2*s.* 9*d.*

When the directors look to the magnitude of the object, which the sum thus expended has been the means of achieving, they think they may fairly congratulate the shareholders upon the general result. In a single session, with no more delay than the forms of Parliament rendered unavoidable, this company has obtained its act of incorporation;—that for which other proprietaries have had to struggle through several sessions, and to pay twice and thrice as much; an act of incorporation, too, which secures to them the perpetual proprietorship of one of the best lines of railway in the whole kingdom, with all the great profits lgitimately derivable therefrom.

The Eastern Counties is not only the longest integral line of railway which has yet obtained the sanction of Parliament, but traverses a larger extent of cultivated and highly productive country than any other; those districts from which the immense population of the metropolis derives its chief supplies of agricultural and marine produce.

From the peninsular character, too, of this portion of England, washed as it is on three sides by the German Ocean and the Thames, it is obvious, that a main-trunk line, which follows, as this does, the ancient and long-established course of traffic, and touches at nearly all the places of greatest business, must draw *and keep to itself* the great bulk of the carrying trade of the district. Other railways may be interfered with, but this never can. As a great main line, it must always stand alone—dividing with no other railway, though receiving the tributary contributions of many.

Another novel and important feature of the Eastern Counties line is, that, notwithstanding its great length, *there will not, from beginning to end, be a single tunnel.*

If at one or two points it goes wider of considerable towns than could be wished, this has arisen from no indifference to the wants of those places, but from the necessity of consulting the general interests of the whole line, and of the majority of those who are to use it, in preference to all minor considerations.

The Eastern Counties Railway will have comptetely fulfilled the purpose for which it was designed, if it serve as the great trunk line of this part of the kingdom, from which branches may radiate into as many of the outlaying districts on both sides, as possess traffic enough to pay for this superior means of communication.

Already not less than six railways, branching from the Eastern Counties line, have been projected with apparently fair prospects of success; all of which, when executed, must contribute more or less to swell the profits of this Company, without involving the necessity of any addition whatever to its capital.

The Directors desire particularly to call attention to the *Thames Haven Railway*, for which an Act of Parliament was obtained in the last session of Parliament, and which is to branch off from the Eastern Counties at Romford. The capabilities of this line are undeniably great. Were it to do no more, than introduce into the heart of Essex a more abundant supply of coal, it would confer an incalculable advantage on that county, and pay the adventurers well; but should it also become, as its projectors confidently anticipate, the great channel for the conveyance of an article of such universal consumption as coal to the metropolis, it would be difficult to assign a limit to its value in a financial point of view. The point chosen for its seaward termination offers also such facilities as a steam-packet station, that there seems strong reason to hope for a large accession of passenger-traffic to both railways from this source.

Next in local order, follow the *Maldon Witham and Braintree*, the *Harwich*, the *Ipswick and Bury*, the *Beceles Bungay and Harleston*, and the *Norwich and Leicester*, branches, which embrace among them nearly all the principal towns of the three counties, which were necessarily left at a distance in the setting out of the main trunk line, but will be now brought by these branches into immediate and productive connexion with it.

To these branches there is yet another to be added, which, though not projected with a view to the wants of any part of the districts immediately intersected by the Eastern Counties Railway, will in all probability prove one of its most valuable tributaries The Directors allude to the recently project-

ed line of railway from London to Rochester and Chatham, *through Essex*; the communication between the opposite sides of the Thames being effected by a short steam-ferry at Tilbury and Gravesend. By taking advantage of the Eastern Counties and Thames Haven lines for about seventeen miles of the entire distance, this railway will be executed for one-fifth of the cost of any line that can be executed *along the Kentish side of the river*. Although this line takes what may at first sight seem a circuitous course, it will, in fact, be little longer than a straight line between the two termini, and exceed by one mile only the distance by the present high road. The number of passengers to and from those parts of Kent, to which this railway will present the shortest possible communication with the metropolis, exceeds at presnnt one million; and assuming that one-fourth only of this immense passenger-traffic will fall to the share of this railway, this will add 25,000*l.* per annum to the revenue of the Eastern Counties Railway, from a source never thought of, or taken into account in the original calcuulations of its promoters.

According to the estimates, which were produced in evidence before the Committee of the House of Commons, and reported by that Committee to be verified to their satisfaction, the traffic of the Eastern Counties. Railway will yield a return of 22 per cent. on the capital required for its formation.—The Directors have since tested this result in a variety of ways; but so far from seeing any reason to doubt its accuracy, they incline to think that the real facts of the case would have fully justified even a higher estimate.

No credit whatever was taken in the Eastern Counties Railway estimates for any of the passenger-traffic from *transmarine* sources as that traffic was, at best, of a contingent character. But, unless the Directors are greatly mistaken, the traffic from these sources alone will suffice to pay the entire expense of working the line, leaving all the revenue derivable from the home traffic to count as so much clear gain.

The counties of Essex, Suffolk, and Norfolk, stand in such a geographical position as regards the northern continent of Europe, and the eastern coast of Scotland, as to offer the nearest route *by railway* from all these parts to the British metropolis. Steam vessels from any continental port north of the Texel, or from any port on the east of Scotland, by putting into Yarmouth which they can now do with the greatest facility at all times of the tide, and landing their passengers there, will enable them to reach London by the Eastern Counties Railway, from 15 to 24 hours sooner than they can now do by water, and, on occasions of contrary weather even two days sooner. To the steam-packets again, from the more southern ports of Rotterdam, Antwerp, Ostend, and Dunkirk, the port of Harwich will present an equally accessible harbor, from which the passengers may, with a proportionate saving of time, proceed to London by the Harwich branch of the Eastern Counties line. Yarmouth and Harwich were, it is well known, formerly the principal packet-stations on the Eastern coast of England, but lost that traffic through the introduction of steam-navigation. It was then found, that by despatching the Hamburgh and other north of Europe mails by steam-vessels direct from the Thames, even though these vessels should not leave the river for eight or nine hours after the mails were made up, the land journey to the outports was saved, and the mails conveyed to their destination in less time, and with more certainty than could be done by steam-vessels from any other point of the coast.—But as soon as a railway communication is established with Harwich and Yarmouth, all this advantage will be lost to the Thames.—The damage which steam has done to these ports as packet-stations the same mighty power will yet be the means of amply repairing. By sending off the mails by the railway to Harwich and Yarmouth as soon as made up, which is, not later than twelve o'clock at night, they will reach these ports by the same hour of the morning at which they now leave the Thames; one half the voyage will be saved; and an entire day, and often much more, gained in the course of transit. And thus, in the same way that the modern steam-vessels supplanted the old sailing-packets, may we surely reckon on seeing the steam-carriages of the Eastern Counties Railway restoring to its former course the passenger-traffic and commercial correspondence, between the British metropolis and the whole of the north of Europe.

The Directors beg, in conclusion, to assure the shareholders that the same spirit of determination which has enabled them to overcome the numerous difficulties which stood in the way of their obtaining the Act for the

Incorporation of the Company, will continue in full vigor till every obstacle to the execution of the trust reposed in them has been overcome. Immediately on the Act being obtained, they directed all the necessary measures to be taken for enabling the engineer to commence operations with the least possible delay at both ends of the line, in order that the two portions of it likely to be the most productive,—namely, the London and Romford, and the Norwich and Yarmouth,—might be the soonest completed and opened; and negotiations for the purchase of the houses and lands required, are already in an advanced state. The expenditure on these parts of the line will be heavier than on any other; but in consequence of the considerable balance of the deposits left in hand, it has not been found necessary to make in the first instance a larger call than 1*l.* per share; and as the Directors have no doubt that this call will be responded to with cordial unanimity, the works will be in full progress before any further call is made on the shareholders.

Since the Act was passed, two vacancies have occurred in the list of gentlemen therein nominated, to constitute for a limited time the first Board of Directors; one by the lamented death of Mr. Crawford, and the other, by the resignation of Mr. Tite, who has since, with much advantage to the interests of the Company, been appointed its surveyor. The Liverpool shareholders, who now hold one-third of the entire stock of the Company, having at a late public meeting expressed a strong desire that they should be represented in the Board by two or more of their number, the Directors, considering this desire to be no more than just and reasonable, have, in virtue of the powers given them by the Act, elected two of the largest shareholders in Liverpool,—namely, Lawrence Heyworth, Esq., and Richard Hall, Esq.,—to succeed Mr. Crawford and Mr. Tite. In thus obeying the voice of the large and respectable portion of their constituency who are resident in Liverpool, the Directors are happy to state that they have at the same time added to their body, two gentlemen whose assiduous habits of business and intimate acquaintance with railway matters, are like to render their accession to the direction of the greatest advantage to the interests of the Company.

It may be proper to add, that by the Act of Parliament a certain fee is authorised to be taken on each certificate of registry and each transfer of shares; but that the Directors, considering that the levying of such a fee would impose an unnecessary tax on the shareholders—in the first stages, particularly, of the undertaking—have ordered that it shall not be enforced.

Signed, on behalf of the Directors,
HENRY BOSANQUET, Chairman,
R. J. HARVEY, Deputy Chairman.
18 Austin Friars, Sept. 26, 1836.

The following letter, addressed to Professor Silliman, and taken from the last number of the American Journal of Science and Arts, is worthy of attention.

Statistical information from the various sections of our extensive territory, will not only add to our own knowledge, but be beneficial to the rest of the world.

It would be curious indeed, to observe the effects of the introduction of manufactures of various kinds, and also of the extension of internal improvement.

No other feasible mode of collecting such data can be suggested, and we hope for the sake of the artist, the student, and the manufacturer, that this letter may receive the proper attention.

ON THE ESTABLISHMENT OF STATISTICAL SOCIETIES IN THE UNITED STATES. TO PROF. SILLIMAN.—The Statistical Society in Paris have selected me as their representative in the United States, for the purpose of transmitting to them any documents which I might be enabled to procure, and for generally aiding their very useful endeavors in Paris, I respectfully desire to propose for consideration the establishment of a "General Statistical Society" in the United States, and to give general publicity to this I have selected your widely circulated Journal as the organ of communication.

The Statistical Society of France was established by Monsieur Cæsar Moreau in 1829; by the high talent of this gentleman, his extensive and varied information, joined with his activity and industry, this society has now the united assistance of almost every government in Europe. The immediate object of the Society rests upon

the fact, that the knowledge of mankind increases in proportion to its tendency to observe, and that Statistical Tables, connected with general and particular information, tend greatly to facilitate this developement.

To gather and condense facts which tend to show the increase or decrease of Population, the prosperity of Arts and Manufactures, the state of public instruction, to develope the true state of Agriculture, and generally to make known the exact internal state of a great nation, its imports and exports, the state of its national funds, and those of Chartered companies, must ever claim the attention of every enlightened community. In aiding the deliberations of Government, I deem it of the highest importance, and I am enabled to state that the European Governments have already experienced great advantages from the labors of Statistical Societies, and from that of France in particular. They have tended to facilitate the views of the Statesman, by offering to him in a condensed form, the internal sources of wealth, not only of his own, but of surrounding nations; their labors render the public happiness more secure, inasmuch as the dark paths of the future may become enlightened by the experience of the past; they offer a solid basis for political and social economy, and they relieve and assist the Ministry, of a Government by condensing and bringing to a focus, not only the minutiæ, but deduced facts relative to the internal or external power of any nation, either remote or in their immediate vicinity.

In the United State of America, however, the existence of such Societies must be of incalculable benefit. The embryo gigantic powers of this Republic are now beginning to develope themselves, and it is of primary importance that the grand stream of prosperity be directed into that course which will not only secure the present prosperity, but also the future greatness of the United States, whilst it must add to the welfare and happiness of her population

The present popular system of rapid and cheap communication, has already been anticipated by the enterprising genius of the United States, and she forms a very prominent example of the immense advantages which a nation derives from the projection of such plans as shall tend to give full scope to the energies of the people, whilst at the same time it opens the paths to the developement of her internal resources, commercial, mineral or agricultural.

To mark out and prudently to direct the course of such facilities of communication, requires the aid of statistic information. The fecundity of the soil, the amount of population, the manufactured products and their separate values, each require particular consideration; and this can be obtained only by personal research. The condensation of such researches forms one of the leading features of a Statistical Society. To accumulate and condense the information given by modern authors, and more particularly that offered by persons who have occasion to visit foreign countries for scientific research, forms the object of the "Universal Statistical Society of France." To contrast the present degree of prosperity with the past, and to inquire into the causes of the increase or diminution, is its particular care; to trace the gradual development of the causes which have influenced the progress, increase, and present actual state of the wealth and power of civilized nations, forms the grand utility to society produced by their united labors; and finally, to contract into one general focus the energies of each nation, and comparing the state of their society both moral and political, their commerce, internal, and their state of Literature and the Fine Arts, with that of another Empire, demands for it the title of "Universal," and eminently merits the zealous support of every enlightened individual, whose nobility of mind prompts him to offer his mite to the general stock of knowledge.

Should this communication through your Journal be the means of having formed in your principal cities, establishments of a statistical nature, be assured that each Society will receive every aid and assistance from the "Universal Statistical Society of France," which will ever be anxious to advance their researches, and to act with them reciprocally.

I have the honor to remain,
Your very obedient serv't,
CHARLES SANDERSON.

Member of the U. S. S. of France, the Imp. Agri. Soc. of Vienna, &c. &c.

New-York, Dec. 10, 1836.

From the Repertory of Patent Inventions.

SPECIFICATION OF THE PATENT GRANTED TO CHARLES WATT, OF CLAPHAM, IN THE COUNTY OF SURREY, GENTLEMAN, FOR CERTAIN IMPROVEMENTS IN PREPARING, PURIFYING, AND REFINING TALLOW, STUFF, FATTY MATERIALS, AND ANIMAL AND VEGETABLE OILS, FOR VARIOUS USEFUL PURPOSES.—SEALED SEPTEMBER 8, 1836.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Charles Watt, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following description thereof, (that is to say):

My invention of improvements in preparing, purifying, and refining tallow, stuff, fatty materials, and animal and vegetable oils, for various useful purposes, consists in subjecting rough fat, tallow, stuff, or other fatty materials, or animal oils to a process of boiling with water, and certain chemical agents, ingredients, materials, mixtures, or compounds hereinafter stated, for the purpose of separating the same from foreign matters and impurities, and rendering the materials better and more fit for the various purposes for which they are used, and particularly, first, as regards tallow for the purpose of separating or liberating the tallow from the animal substances, containing gellatin, fibrin, albumen, or coloring matter, and if necessary, afterwards washing or purifying or refining the same in order to remove the said chemicals. And further, as regards animal oils, in submitting them to a similar process of boiling with certain chemical ingredients for the purpose of removing impurities and refining or purifying the same; and after this first boiling, washing or boiling them a second time with certain other chemicals, to remove or neutralize the former, and, at the same time, purifying, refining, or washing the oils. And lastly, in refining or purifying vegetable oils by operating upon them with certain chemical agents, materials, mixtures, or compounds, for the purpose of removing impurities, coloring, glutinous matters, or offensive odors therefrom; all of which processes or operations have for their object the preparing, purifying, and refining the various raw materials, and rendering them better and more fit for various purposes, and which I propose to carry into effect in the following manner. And in order that my improvements may be better understood, I shall detail the processes or operations, stating such proportions, quantities of water, acids, and other chemical agents, materials, ingredients, or compounds, as I have found best to answer the desired purpose; but I do not intend to confine myself to the precise quantities hereinafter stated, as the same may be varied to suit different qualities and states of foulness or coarseness of the stuff, rough fat, tallow, or oils, or other raw materials to be operated upon, as is well known to all tallow melters and refiners of oils.—First, as regards the operation or process of rendering or preparing rough fat, stuff, or fatty materials for the melting or refining and purifying of tallow, I proceed in the following manner: the rough fat, without the necessity of being previously prepared or chopped into small pieces, is to be put into a wooden rendering vat, furnished with a wooden steam pipe leading from a steam boiler or generator, and branching out into several other pipes placed in the bottom of the vat, and pierced with small holes in order to distribute the steam throughout the whole mass of materials under operation. To about each ton of rough fat in the rendering vat I add about four gallons of water and then let on the steam and continue it until the mass boils, when I add, as hereafter directed, the following chemical mixture or compound prepared an hour or more before it is wanted. First, I take four pounds of good sulphuric acid (which I prefer to be of the specific gravity of about 1900), which is gradually and continuously to be diluted by pouring it very slowly into two gallons of cold water contained in a wooden vessel, the water being repeatedly stirred with a stick during the mixing; or muriatic acid may be substituted for sulphuric acid, when eight pounds of it will be required instead of four of the former, and only half the quantity of water; in this case there is no necessity for any particular caution in the mixing as with sulphuric acid, as there is no disengagement of heat. To either of the above mixtures of diluted acids, when cold, I add one pound of good

nitric acid, which I prefer of about the specific gravity 1045, and then half a pound of the bichromate of potassa, in order to supply an additional quantity of oxygen and to prevent any discoloration by the use of the nitric acid; and to these I add half a pound of oxalic acid; the whole is then to be well stirred, and, when sufficiently mixed, one quart or three pints of this compound (to each ton of rough fat or stuff) is to be put into the boiling materials in the rendering vat, at intervals of about every twenty or thirty minutes, and the boiling continued until the dabs or lumps are nearly dissolved; when this is the case, I add to the materials under operation the following compound (prepared only at the time it is about to be used); I first (in the proportion of to every ton of fat or stuff) dilute or mix one pound of strong nitric acid with one quart of water, into which mixture I put two ounces of rectified spirit of wine, naptha, sulphuric ether, or spirit of turpentine; after this compound has been added to the fat under operation, the boiling is to be continued for about half an hour, and after all the dabs or pieces of fat are rendered or melted the steam is to be stopped off and the tallow left quiet about ten minutes for the purpose of allowing the refuse to settle, when the water and chemicals underneath the tallow are to be drawn off, and about two gallons of fresh water to each ton of rough fat or stuff is to be then put in the rendering vat, and the steam let on again and continued till the tallow has boiled about ten minutes. After this washing process, the boiling is to be stopped, and the materials left to settle, in order that the tallow may become cool and fit to be packed off. In rendering fish oils in wooden vessels that is boiling or melting, and partly refining and purifying, such as whale blubber, fish livers, and other parts containing fish oils, the following modification of the process is necessary. The rendering mixture in this case should contain the following proportion of sulphuric and muriatic acids: viz., four pounds of the former diluted with two gallons of water, as described in the former part of this specification (respecting tallow), and six of the latter acid also diluted with two gallons of water, these diluted acids are to be mixed together after the diluted sulphuric acid has become cold; and to this compound is then to be added and well stirred therewith, half a pound of bichromate of potassa and a like quantity of oxalic acid. This compound is to be added to the boiling rough materials containing animal oils at intervals of twenty or thirty minutes, in the proportion of two quarts, at each time of adding, to every ton of materials under operation, until all the fatty or oily substance (such as whale blubber, livers of fish, and other parts containing oil) are reduced or rendered. This will be shown on examining the mass under operation and indicated by any parts containing oil floating beneath the surface of the fluid oil, and above the surface of the water, and thereby the operator will know if the process is to be stopped or continued; after this oporation is performed, the under liquids and chemicals may be drawn off, about two pounds weight of powdered chalk or marble to each ton of raw material is to be thrown into the vat and well stirred therewith, when the whole is to be boiled for ten or twenty minutes in order that the chalk or marble may combine with and remove any acid adhering to the oil. The now rendered or purified oil is then allowed to settle, when it may be removed for use. In the further refining and purifying of tallow, if necessary or thought desirable, at the time the fresh water is put into the vat after the pumping or drawing off the under water and chemicals, the rendering being completed, there may be added to every ton of tallow a half pound of green oxide of chrome or bichromate of potassa, and boiled with the materials under operation for about ten or fifteen minutes, by turning on the steam the color, odor, and other properties of the tallow, will be much improved by the process. In refining and purifying animal and vegetable oils generally, when in their fluid state, as articles of commerce, I use the following process and compound:—to every ton of oil is to be added a quantity, say one quart of the before mentioned mixture of muriatic acid and oxide of chrome or bichromate of potassa, the oil being stirred well at each time this compound is added, the operation or commixture to be continued until all the offensive odor, coloring matter, or impurities are removed; I then introduce about three gallons of water to every ton of oil, and from two to three pounds of powdered chalk or marble, to remove any acids ad-

hering to the oils; the oil is then to be left quiet until all the chemicals and water have settled and it has become transparent, when it may be run off into barrels for use. In the case of palm oil, it being ordinarily in a solid state, it must be raised by artificial heat to the temperature of about 120 Fahrenheit's thermometer, and the refining mixture will require to contain in the proportion of about one pound and a half of green oxide of chrome or bichromate of potassa, and four pounds of muriatic acid to each ton of rough materials, instead of the former proportions, and, when the coloring matters are moved, the same quantity of chalk or marble is to be added as in the former case, and three or four gallons of water, and the whole raised to the temperature of about 150°, when the materials will become sufficiently fluid to allow all the chemicals to subside, and after they have been sufficiently stirred together, the whole may be left at rest a sufficient time to allow the oil to become clear and the chemicals to subside, when the oil may be used in various manufactures. Having now described my improvements, and the manner of carrying the same into effect, and in such proportions and quantities as I have found to answer the purpose, I wish it to be understood that what I claim as my improvement in the preparing, purifying, and refining tallow, stuff, fatty materials, and animal and vegetable oils, for various useful purposes, is the boiling and operating upon them by the following compounds, chemical agents, ingredients, or mixtures. First, I claim the combination of sulphuric and nitric acids, and muriatic and nitric acids, for the purpose of rendering in wooden vessels, and likewise oxalic acid, both singly and compounded, as described, and likewise the bichromate of potassa, as it much improves the tallow and prevents the occasional temporary discoloration occasioned by nitric acid; I likewise claim the combination of nitric acid with spirits of wine, naptha, ether, or furpentine, as evolving nitrous gas and nitrous oxide for the purpose of rendering, and by their agency purifying and solidifying the tallow; I also claim the admixture of sulphuric and muriatic acids, and oxalic acids, in rendering fish oils, as whale, seal, cod, &c. &c. I also claim the combination of muriatic acid with oxide of chrome, by which combination there results a double effect, viz.: the bleaching or purifying and refining effect of the bichromate of potassa, or oxide of chrome, with the immense evolution of chlorine gas resulting from the decomposition of the muriatic acid or bichromate of potassa, for refining and bleaching vegetable and animal oils, generally and particularly, as applied to palm oil, which I prefer operating upon at about the temperature of 120°, being that at which the effect is rendered most certain of success and steady operation. In witness whereof, &c.

Enrolled September 8, 1836.

LAUREL HILL CEMETERY.

We have lately visited, with no common feeling of admiration the new and beautiful rural burying ground which a few liberal minded citizens have provided at Laurel Hill, on the river Schuylkill, just below the Falls, and about three and a half miles from the heart of the city. In situation and capabilities it is every thing that could be desired, realizing the wish of the poet to the very letter:—

"Mine be the breezy hill that skirts the dawn,
Where a green grassy turf is all I crave,
With here and there a violet bestrown,
Fast by a brook of fountain's murmuring wave,
And many an evening sun shine sweetly on my grave."

Here the last resting place of friends and relatives may be visited without any of those disagreeable associations connected with our city grave yards. Here the visiter will not be shocked with the mouldering coffin or sunken yawning grave; here the dead will repose amid the beauties of nature, and their memories be associated with the most soothing and most simple emblems of mortality—emblems that are at once the most eloquent advocates of religion, and morality, and the most determined foes to unnatural fear and superstition. Here will be found the tokens of a true and heightened feeling of respect towards that which is again to spring into life—which at once attests man's superiority to the rest of creation, and inculcates the salutary conviction that the spirit lives eternally.

Following out an enlarged view of what will be permanently useful, the proprietors have erected a handsome entrance, of graceful Roman Doric architecture, enclosing Porters' Lodges, &c.; a handsome Gothic Chapel, and a Superintendant's Cottage: a large receiving tomb is ready for those who

may have occasion to employ it while they are erecting their own. The very large dwelling house is to be converted into one spacious room large enough for any procession to take shelter in; this and the Chapel will be warmed in winter. In addition, there are spacious coach houses, so that as far as we could judge nothing has been neglected, and the public, while they will be amply accommodated, will have cause to remember those by whom this much needed improvement has been effected.

The Cemetery is one hundred feet above the Schulykill, which washes it on the West, and is bounded on the East by the ridge road turnpike; the latter affords ready access in all seasons. East of the ridge road the company have a small farm which has been converted into a flower garden and nursery; its superintendant, Mr. John Sherwood, formerly gardner to Mr. Platt, will supply shrubbery for lot holders, and at their request keep their lots in perpetual bloom with roses, &c.

The company will no doubt receive a charter from the present Legislature, and give deeds in fee simple ferever to purchasers, subject to wholesome rules satisfactory to all; the price, considering the heavy outlay, is esteemed very reasonable. A very large number of citizens have purchased, and every day adds to their number.

New-York and Baltimore, by municipal regulations have enacted that no burials shall take place within the city; it behoves all of us to anticipate such a law here, and by the removal of our deceased friends to this spot, or by preparation for our families, make arrangements for their quiet repose hereafter TOGETHER. We observed that families, brothers, sisters and cousins, &c., are selecting their lots in the vicinity of each other, that those who were united in their lives may not be separated. Husbands are removing their deceased partners, wives their husbands, children their parents, and parents their children, from the closely crowded grave yards of the city, and with pious care depositing them where they can join them when their earthly pilgrimage is over. Already is the ground studded over with a hillock or a grave stone here and there, and we learn from the Superintendant that very many removals are immediately contemplated.

Alexander Wilson, the distinguished ornithologist expressed a natural wish that he might be buried "where the birds would sing over him;" will not our citizens all unite in heart and purse to carry his wish into execution? We understand such a proposition is entertained, and that a prospectus has been issued to transfer the bodies of Wilson, Godfrey, the undoubted inventor of the Quadrant, Rittenhouse, and Say, to Laurel Hill, and erect over them a mausoleum with suitable inscriptions. Every one we should suppose would contribute to this laudable object.—[Philadelphia Com. Herald.]

From Ure's Philosophy of Manufactures.

GENERAL VIEW OF MANUFACTURING INDUSTRY.

(Continued.)

In an analysis of manufacturing industry, the general functions of machines, and the effects of their improvements, ought to be well considered. Machines are of three kinds:—

1. Machines concerned in the production of power.

2. Machines concerned in the transmission and regulation of power.

3. Machines concerned in the application of power, to modify the various forms of matter into objects of commerce.

I. Machines engaged in producing power operate by counteracting gravity, inertia, or cohesion. The steam engine, by the expansive agency of vapor, raises and depresses its ponderous piston, and thereby moves its massive beams and geering.—The hydraulic wheel produces similar effects by the natural flow or fall of water from a higher to a lower level; and the windmill by the currents of the atmosphere. Blasting of rocks, in mining, exhibits elastic power overcoming cohesion.

II. The machines engaged in transmitting and regulating power are, toothed wheels, fly wheels of various kinds, valve governors, shafts, and other geering of mills.

III. The machines engaged in applying power to modify the forms of matter appear, at first sight, to be so multifarious as to set systematic arrangement at defiance. An outline of their connexions and dependencies has been attempted in the next chapter.

The philosophy of manufactures is well displayed in the economy of power. The value of steam impelled labor may be inferred from the following statement of facts, communicated to me by an eminent engi-

neer, educated in the school of Bolton and Watt :—A manufacturer in Manchester works a 60-horse Bolton and Watt's steam-engine, at a power of 120 horses during the day, and 60 horses during the night; thus extorting from it an impelling force three times greater than he contracted or paid for. One *steam* horse-power is equivalent of 33,000 pounds avoirdupois, raised one foot high per minute; but an *animal* horse-power is equivalent to only 22,000 pounds raised one foot high per minute, or, in other terms, to drag a canal boat 220 feet per minute, with a force of 100 pounds acting on a spring: therefore a steam horse-power is equivalent in working efficiency to one living horse, and one-half the labor of another. But a horse can work at its full efficiency only eight hours out of the twenty-four, whereas a steam-engine needs no period of repose; and therefore to make the animal power equal to the physical power, a relay of $1\frac{1}{2}$ fresh horses must be found three times in the twenty-four hours, which amounts to $4\frac{1}{2}$ horses daily. Hence a common 60-horse steam-engine does the work of $4\frac{1}{2}$ times 60 horses, or of 270 horses. But the above 60-horse steam-engine does one-half more work in twenty-four hours, or that of 405 living horses!—The keep of a horse cannot be estimated at less than 1*s.* 2*d.* per day; and therefore that of 405 horses would be about 24*l.* daily, or 7500*l.* sterling in a year of 313 days. As 80 pounds of coals, or one bushel, will produce steam equivalent to the power of one horse in a steam-engine during eight hours' work, sixty bushels, worth about 30*s.* at Manchester, will maintain a 60-horse engine in fuel during eight effective hours, and 200 bushels, worth 100*s.*, the above hard-worked engine, during twenty-four hours. Hence the expense per annum is 1565*l.* sterling, being little more than one-fifth of that of living horses. As to prime cost and superintendence, the animal power would be greatly more expensive than the steam power. There are many engines made by Bolton and Watt, forty years ago, which have continued in constant work all that time with very slight repairs. What a multitude of valuable horses would have been worn out in doing the service of these machines! and what a vast quantity of grain would they have consumed! Had British industry not been aided by Watt's invention, it must have gone on with a retarding pace, in consequence of the increasing cost of motive power, and would long ere now, have experienced, in the price of horses, and scarcity of water-falls, an insurmountable barrier to further advancement, could horses, even at the low prices to which their rival, steam, has kept them, be employed to drive a cotton mill at the present day, they would devour all the profits of the manufacturer.

Steam-engines furnish the means not only of their support but of their multiplication. They create a vast demand for fuel; and, while they lend their powerful arms to drain the pits and to raise the coals, they call into employment multitudes of miners, engineers, ship-builders, and sailors, and cause the construction of the canals and railways: and, while they enable these rich fields of industry to be cultivated to the utmost, they leave thousands of fine arable fields free for the production of food to man, which must have been otherwise allotted to the food of horses. Steam-engines moreover, by the cheapness and steadiness of their action, fabricate cheap goods, and procure in their exchange a liberal supply of the necessaries and comforts of life, produced in foreign lands.

Improvements in machinery have a three-told bearing :—

1st. They make it possible to fabricate some articles which, but for them, could not be fabricated at all.

2d. They enable an operative to turn out a greater quantity of work than he could before—time, labor, and quality of work remaining constant.

3d. They effect a substitution of labor comparatively unskilled, for that which is more skilled.

The introduction of new machines into any manufacture, with the effect of superseding hand labor, is tempered by the system of patents, which maintains them for a certain time at a monopoly price, and thereby obstructs their rapid multiplication. Did we admit the principles on which the use of particular self-acting mechanisms is objected to by workmen, we should not be able, in any case, to define the limits of their application. Had parliament acted on such principles sixty years ago, none of our manufactures could have attained to their present state of profitable employment to either

masters or men. The immediate causes of their vast augmentation may be ascribed, under the blessing of Providence, to the general spirit of industry and enterprize among a free and an enlightened people, left to the unrestrained exercise of their talents in the employment of a vast capital, pushing to the utmost the principle of the analysis of labor, summoning to their service all the resources of scientific research and mechanical ingenuity; and finally, availing themselves of all the benefits to be derived from visiting foreign countries, not only in order to form new and confirm old commercial connexions, but to obtain an intimate knowledge of the wants, the tastes, the habits, the discoveries and improvements, the productions, and fabrics of other civilized nations. Thus we bring home facts and suggestions; thus we perfect our old establishment, and add new branches to our domostic stock; opening, at the same time, new markets for the sale of our manufacturing and commercial industry, and qualifying ourselves for supplying them in the best and most economical manner. By these means alone, and, above all, by the effect of machinery in improving the quality, and cheapening the fabrication of our various articles of export, notwithstanding an immense load of taxes, and a higher price of grain, our commerce and manufactures have also increased in such a degree, as to surpass the most sanguine calculations of the ablest political economists who have speculated on the prospects of mankind. We should never cease to bear in mind, that we are surrounded by powerful nations, composed of a people equally industrious, and more sober than ourselves, who, released from the turmoil of war, are intent on cultivating the productive arts of peace, and of pushing their commerce and navigation; whose eagerness of competition is stimulated by the view of the rich prizes which we have already won.

The attempts continually made to carry our implements and machines into foreign countries, and to tempt our artisans to settle and superintend them there, evince the high value set by other nations on our mechanical substitutes for hand labor; and as they cannot be directly counteracted, they should be rendered, as far as possible, unavailing, by introducing such successive improvements at home as may always keep us foremost in the career of construction. It would be therefore no less disastrous to the operative, than to the capitalist, were any extraneous obstacles thrown in their way, since any good machine suppressed, or rejected, in this country, would infallibly be received with open arms by some of our neighbors, and most readily by our mechanical rivals in France, Belgium, Germany, and the United States.

Mill architecture is a science of recent origin, which even at this day is little understood, beyond the factory precincts. It had been ably begun by Mr. Watt, but, till it fell into the hands of Messrs. Fairbairn and Lillie, the eminent engineers of Manchester, it was too subject to the whims of the several individuals, often utterly ignorant of statics or dynamics, or the laws of equilibrium and impulse, who had capital to lay out in building a mill. Each had his own set of caprices and prejudices, which he sought to embody in his edifice, little aware how much the different orders of machines depended for the productiveness and precision of their performance, on the right magnitudes, proportions, and adjustments of the mainshafting and wheel-geering.—These are, in fact, the grand nerves and arteries which transmit vitality and volition, so to speak, with due steadiness, delicacy, and speed, to the automatic organs. Hence, if they be ill-made or ill-distributed, nothing can go well, as happens to a man laboring under aneurismal and nervous affections.

About three years ago, the above named engineers dissolved a partnership celebrated over the world; since which time each has expanded his energies, and distinguished himself in a peculiar line of work. I shall have occasion hereafter to describe several of Mr. Lillie's excellent mechanical constructions. Mr. Fairbairn has entered largely into the line of factory architect, for which his three-fold great workshops are admirably adapted. The capitalist has merely to state the extent of his resources the nature of his manufacture, its intended site, and facilities of position in reference to water or coal, when he will be furnished with designs, estimates, and offers on the most economical terms, consistent with excellence, according to a plan, combining elegance of external aspect, with solidity, convenience, and refinement in the internal structure. As engineer he becomes re-

sponsible for the masonry, carpentry, and other work of the building, for the erection of a sufficient power, whether of a steam-engine, or water-wheel, to drive every machine it is to contain, and for the mounting of all the shafts and great wheels by which the power of the first mover is distributed. The frontispiece of this volume exhibits a perspective view of a magnificent factory, lately finished by Mr. Fairbairn, and now at work under its spirited proprietor, Mr. Orrell. It is beautifully situated in the environs of Stockport, on a branch of the Mersey, the great river feeder of the cotton trade of England. In beauty of architectural design, it will yield to no analogous edifice, and, may indeed, bear a comparison in respect of grandeur, elegance, and simplicity, with many aristocratic mansions. The length of the apartments in each floor of the body of the house is three hundred feet, the breadth fifty feet, and the height of each floor twelve feet. Each window consists of two casements, extending from its top to its sill, one of which, nearly as large as a common window, may be thrown entirely open for admitting fresh air, independent of the mechanical ventilation. I have been favored, through the liberality of the architect and proprietor of this pattern structure, with an analytical section and ground plan of it, by which I shall be enabled, in the treatise on the cotton trade, to place before my readers a view of the whole anatomy of the mill, in the following order.

1. Its two-fold heart, or twin steam-engines, one of which makes its maximum effort, while the other makes its minimum, to secure perfect equability of impulsion through all the ramifications of the shafts, and to prevent arterial throbbing or tremor, formerly so common, and so injurious to the work of delicate machines.

2. The great bevel wheel-geering, which transmits the power of the engine in rectangular directions, either transversely or vertically, and with any modification of speed.

3. The horizontal and upright shafts, with their several pulleys.

4. The distribution of the strape, or belts, that convey the power from these revolving shafts and pulleys.

5. The respective positions of the various productive organs in their respective floors, such as the preparation machines, throstles, mules, power-looms, dressing machines, warping mills, &c. &c.

The recent innovations in proportioning the sizes, regulating the connections, and adjusting the movements of the system of shaft-geering, form a fine feature in the philosophy of manufactures. Thus not only an improvement has been made in the regularity of impulsion, but a considerable increase of power from the same prime-mover has been obtained; amounting in some cases, of old mills remounted by Messrs. Fairbairn and Lillie, to fully twenty per cent. The durability of shafts so exquisitely turned and polished, is another great advantage. The spinning factory of Messrs. Ashworth, at Egerton, which has been at work for several years, exhibits an elegant pattern of the engineering just described: for it has some subordinate shafts, hardly thicker than the human wrist, which convey the power of ten horses, and revolve with great speed, without the slightest noise or vibration. The prime-mover of the whole is a gigantic water-wheel of sixty feet diameter, and one hundred horses' power. I have frequently been at a loss, in walking through several of the millwright factories, to know whether the polished shafts that drive the automatic lathes and planing machines, were at rest or in motion, so truly and silently did they revolve.

The method of increased velocities in the driving arms or shafts of factories, is undoubtedly, one of the most remarkable improvements in practical dynamics. It diminishes greatly the inertia of the mass to be moved, by giving to much lighter shafts and wheels the same momentum, and it permits the pulleys or drums, which immediately impel the machines by straps, to be reduced to a size much nearer to that of the steam pulleys fixed on the main axes of these machines. About thirty years ago the velocities of the main shafts, proceeding from the moving power, whether of steam or water amounted to no more than from thirty to forty evolutions per minute, and of the smaller and remoter shafts, to only forty or fifty. At the same period the drums were heavy tubs, and from thirty, to upwards of sixty inches in diameter. The improved system is under deep obligations for its actual state of perfection to the above-named engineers, though it had commenced, as we have stated, before their

time. In the mills mounted by these gentlemen it is interesting to see slender shafts, like small sinewy arms, rapidly transmitting vast power through all the ramifications of a great factory.

The following details will place this matter in the clearest light :—A mill propelled by a steam-engine of fifty horses' power was formerly geered with shafts, having an average transverse section of thirty-six square inches, or varying in size from four to eight inches square. An engine of like power at the present day will, in consequence of the increased velocities above described, work with cylindrical shafts not exceeding five and a half, and often only three inches in diameter; possessing therefore an average area of only fifteen square inches, instead of thirty-six. The horizontal shafts that run under the ceilings of the different working rooms are two inches, and seldom exceed two and a quarter in diameter. Hence the mass of geering has been reduced fully one-half. But the shafts now make from one hundred and twenty, to one hundred and fifty revolutions in a minute, and, occasionally, as where trostlers are turned, so many as two hundred in the same time. Thus we see the requisite momentum is gained with a light shaft, while the friction is proportionally diminished, and the driving drum revolves with a velocity in accordance with the accelerated pace of the modern machines. The several speeds will be given in discussing their respective subjects.

The philosophy of manufactures investigates, in the next place, the most economical and energetic modes of applying the motive force to the various working organs; the carding-engines, the drawing-heads, the roving-frames, the throstles, the mules, the power-looms, the dressing-machines, &c.

The British capitalist is vigorously seconded by the British engineer, and need not, like the Continental adventurer, leave his funds long dormant, after an opportunity of placing them profitably in factory enterprise occurs. One mill-wright establishment in Manchester turns out from three hundred to four hundred yards of shaft-geering every week, finely finished, at a very moderate price, because almost every tool is now more or less automatic, and performs its work more cheaply and with greater precision than the hand could possibly do. Where many counterparts or similar pieces enter into spinning apparatus, they are all made so perfectly identical in form and size, by the self-acting tools, such as the planing and key-groove cutting machines, that any one of them will at once fit into the position of any of its fellows, in the general frame.

For these and other admirable automatic instruments, which have so greatly facilitated the construction and repair of factory machines, and which are to be found at present in all our considerable cotton mills, this country is under the greatest obligations to Messrs. Sharp, Roberts and Co. of Manchester. By such aids, fine-cotton spinners are enabled to mount their mules and the subservient frames within their own premises, with peculiarities of construction suited to their style of work; and many of them remodel more or less the apparatus made in the machine-shops. Thus the bobbin and fly-frames of Messrs. Cocker and Higgings, so justly admired, require occasionally to be modified in certain minutiæ, essential to fine work, before being used by certain manufacturers. It is this skill in machine mounting or adjusting, combined with tact in spinning, which gives to our factories not merely their existing superiority over foreign rivalry, but the best security for its permanence. Indeed, the concentration of mechanical talent and activity in the district of Manchester and Leeds is indescribable by the pen, and must be studied confidentially behind the scenes, in order to be duly understood and appreciated.

The following anecdote will illustrate this position. A manufacturer at Stockport, whose name I shall suppress, being, not long ago, about to mount two hundred power-looms in his mill, fancied he might save a pound sterling in the price of each, by having them made by a neighbor machine-maker, instead of obtaining them from Messrs. Sharp and Roberts, in Manchester, the principal coustructors of power-looms. In order to give his fabricator every chance of success, the economist surreptitiously procured iron patterns cast from one of the looms of that company, which in its perfect state costs no more than £9. 15*s*. His two hundred looms were accordingly constructed at Stockport, supposed to be facsimiles of those regularly made in Manchester, and they were set to work. Hardly a day passed, however, without one part or

another breaking down, insomuch that the crank or tappet-wheels had to be replaced three times, in almost every loom, in the course of twelve months. The fabric of the cloth was also indifferent. The proprietor perplexed beyond measure, inquired of a neighbor who worked similar power-looms, made by the Manchester mechanicians, whether *his* wheels likewise went to pieces every other day, and learned to his mortification, that not one of them had broken in the course of working, but that the four or five spare ones, originally sent from Manchester along with his two hundred and thirty-six power-looms, were unused and quite at his service. The old proverb of 'penny wise and pound foolish' never had a better illustration. His weaving factory had been most irregular and unproductive, while that of his neighbor had been uniformly prosperous. Being now heartily sick and ashamed of his fac-simile copies, he took measures in secret to have them replaced, as soon as possible, by Sharp and Roberts's substanclal machines.

The astonishing expedition with which a great Cotton Factory, comprehending spinning and weaving, can be erected in Lancashire, arises from the vast collections of patterns of every variety, from those of gigantic steam-engines, water-wheels, iron-girders, and joists, down to the smallest member of a throstle or loom, in possession of the engineers, mill-wrights, and machine-makers. In the course of last year, Mr. Fairbairn equipped water-wheels equivalent to 700 horses' power, and steam-engines to 400 horses' power, from his engineer factory alone, independent of his mill-wright, and steam-boiler establishment. Hence, whenever capital comes forward to take advantage of an improved demand for goods, the means of fructifying it are provided with such rapidity, that it may realize its own amount in profit, ere an analogous factory could be set a-going in France, Belgium, or Germany.

The facilities resulting from the employment of self-acting tools have not only improved the accuracy, and accelerated the construction of the machinery of a mill, but have also lowered its cost and increased its mobility, in a remarkable degree. At present, a throstle frame made in the best manner may be had complete at the rate of 9*s.* 6*d.* per spindle; and a self-actor at about 8*s.* per spindle, including the patent licence for the latter. The spindles in cotton factories move with so little friction that one horse power drives 500 on the fine hand-mule, 300 on the self-actor mule, and 180 on the throstle; which power includes all the subsidiary preparation machines, as carding, roving, &c. A power of three horses is adequate to drive 30 large looms with their dressing machine.

The fine bobbin and fly-roving frame, is now so greatly improved, that it can do a certain part of the work formerly done by the stretching mule; and performs as much for 9*s.* as the other did for 50*s.*

The dressing machine does at present 200 pieces of thirty yards each in a week,=6000 yards, and costs in wages to the dresser 50*s.* This branch of the trade having in consequence of the high wages been, like the mule spinning, continually disturbed by unions and strikes, has led to the invention of a self-acting machine which will dress at least 6000 yards of warp in two days, under the superintendence of a laborer at 3*s.* a-day; that is, at a cost in wages of 6*s.* This mechanism is at the same time greatly simpler and cheaper than the former, and will soon come into general use for coarse calicoes. It affords an instructive warning to workmen to beware of strikes, by proving how surely science, at the call of capital, will defeat every unjustifiable union which the laborers may form.

It is one of the most important truths resulting from the analysis of manufacturing industry, that unions are conspiracies of workmen against the interests of their own order, and never fail to end in the suicide of the body corporate which forms them; an event the more speedy, the more coercive or the better organized the union is. The very name of union makes capital restive, and puts ingenuity on the alert to defeat its objects. When the stream of labor is suffered to glide on quietly within its banks, all goes well; when forcibly dammed up, it becomes unprofitably stagnant for a time, and then brings on a disastrous inundation. Were it not for unions, the vicissitudes of employment, and the substitution of automatic for hand work, would seldom be so abrupt as to distress the operative.*

Some may imagine that the present work,

* The full discussion of this topic belongs to Book III.

which purposes to give a minute analysis and description of the several processes of manufacture, may prove injurious to the trade of this country, by putting foreigners in possession of much useful knowledge, now hardly within their reach. To this I reply, that knowledge is available just in proportion to the capacity and means of the persons who acquire it. Every invention and improvement relative to cotton fabrics is primarily attracted to Manchester as the surest and most productive scene of its development, where it can be most profitable to the inventor, because most profitable to the trade concentred there. Lancashire is the fertile and well-labored soil in which the seed of factory knowledge will bring forth fruit one hundred fold, whereas abroad it can yield little more than a tenfold return. However well informed the mill proprietors of Great Britain may be, and they unquestionably may bear a comparison in talent as in wealth with the landed aristocracy in any part of the world, still they may profit extremely by the methodical study of the elements of their prosperity. Many of the machines at present employed by them involve the most elegant applications of both physical and mechanical science; such indeed as if duly studied would enable them to understand the operative part of their business as clearly as the commercial, and thus protect them from those hazardous innovations which crafty projectors are perpetually pressing upon their adoption. Prodigious sums are wastefully expended every year by gentlemen manufacturers in this way, which would be saved by a more thorough acquaintance with those principles of science and art which I shall endeavor to expound.

Several individuals who have embarked vast fortunes in factories are to a very great extent the victims at least, if not the dupes, of scheming managers, who are ever ready to display their perverse ingenuity by the substitution of some intricate trap, for a simpler but less showy mechanism. I have known not a few cases, where a complete system of good machines, capable of doing excellent work, has been capriciously turned out of a cotton factory and replaced by another of greater expense, but of less productive powers, and less suited to the style of work, than the old one if skilfully managed. These substitutions are continual in many establishments. They interfere most essentially, and often unnecessarily, with the going of the mill, and are referrible almost always to injudicious choice at first, and capricious alterations afterwards,—circumstances over which the proprietor, from ignorance of the structure of a good machine, cannot always venture to exercise the proper control. There are no doubt many mill-managers perfectly fitted by judgment, knowledge, and integrity to second the sound commercial views of the mill-owner, and to advance the business with a profitable career. These practical men form the soul of our factory system. But with a wrong-headed, plausible manager, the proprietor is sure to be led such a mechanical dance as will bewilder him completely, unless he has acquired a clear insight into the *arcana* of the business by deliberate study of the composition and performance of each machine in his factory. It may be supposed that this species of education can be most easily acquired in the midst of the machinery itself. But this is a mistake which experience speedily proves.

There exists in most cotton-spinning factories a beautiful piece of mechanism called the bobbin and fly frame, regulated by a principle of self-acting equations, which would do honor to the genius of Brunel. In venturing to affirm that very few mill-owners understand the structure of this machine, I do not draw the inference presumptuously from the difficulty which I myself encountered in comprehending the automatic adjustments of its parts; but from meeting with several masters of the Manchester mills who were incompetent to explain the train of its motions, however obligingly they undertook the task. In fact one scientific gentleman, a complete master of that mechanism and of every other used in the trade, who kindly acted on many occasions as Mentor in my factory researches, assured me that his father, a very talented cotton-spinner, as the country well knows, never can retain a clear comprehension of certain differential adjustments in the above machine for a week after it has been explained to him. Some of its movements being necessarily inclosed, and of a curious nature, can be best studied in an analytical drawing, where the whole concatenated motions are brought at once

under the student's eye. Such complex mechanisms, indeed, like the topography of an irregular city, are most readily comprehended by inspection of a plan, in which the mutual bearings and connexions of the parts are analytically shown. The representations which I shall have the honor of presenting to the public were made by a talented draughtsman, who accompanied and lived with me in the factory districts, and they were submitted to some of the most eminent engineers and machine-makers of Manchester, from whom they received unqualified praise for accuracy as well as elegance of execution.

I shall conclude this general view by stating, that the moving power, besides performing its proper factory tasks of carding, roving, spinning, weaving, &c., does a vast deal of miscellaneous drudgery. It raises the coals from their bin in the boiler-yard by a sloping series of buckets, like those of a dredging machine for deepening rivers, and delivers them on an elevated railway platform into a waggon—through the drop-bottom of which they are duly distributed among the range of hoppers attached to Stanley's ingenious furnace-feeding machines, and are thereby strewn into the fires in proportion to the demand for steam to work or warm the mill. In this way the fire-man is entirely freed from muscular effort, so that he can tend with ease many great steam-boilers, and is not liable through ignorance or negligence to mismanage the heat, or dissipate the fuel in such black clouds as lower over a London brewery. It is no uncommon thing in Manchester to see engine-boilers equivalent to the force of from 200 to 300 horses generating their steam without any sensible smoke.

But their is another office more truly menial assigned to the engine, that of transporting any of the work-people upwards or downwards to any floor of the factory, to which their business may call them at any time, and this with equal celerity and safety. To ascend and descend rapidly through several flights of stairs is no trifling source of fatigue, as domestic servants in some fashionable houses well know. Masters of mills, with the twofold motive of benevolence and economy, have long ago taken measures to supersede this painful exertion, by the construction of moveable platforms, inclosed in upright tunnels placed in convenient parts of their many-stored buildings. This apparatus is called a hoist or a teagle, and is usually of such size and stability, as to allow half a dozen of persons, old and young, to travel at once from any one floor to any other.—The motion is perfectly smooth and agreeable, as I have often experienced; and is so entirely under control, as to cease at any desired instant opposite to any of the issue-doors in the side of the tunnel.

The muscular force expended in mounting stairs was made the subject of experiment by M. Coulomb. Amontons had previously found that an active man, weighing 150 lbs. English, was completely exhausted in ascending, by steps, sixty-five feet in thirty-two seconds. The full work of a man is obtained by his going up stairs at the rate of forty-five feet in one minute.—A man weighing 160 lbs. can ascend by stairs three feet per second for a space of fifteen or twenty seconds; and if he be supposed going up stairs for a day, he actually raises 450 lbs. to the height of 3281 feet; or 1,476,450 lbs. one feet high. If the day be reckoned at ten hours, or 600 minutes, he will raise 2460 lbs. one foot high in a minute, which is only one-thirteenth of Watt's estimate of a horse's power=32000 lbs. raised one foot high per minute. With a winch a man does, according to Coulomb, only five-eights as much work as in going up stairs. If the above observations be nearly correct, they prove the expenditure of power in ascending stairs to be great. Coulomb says that this mode of action is the most advantageous for the muscular force of man, though he rates its amount at little more than one-half of Smeaton's estimate of an English laborer's force.

The mechanism of the teagle will be understood by the following description and drawing taken from one of the most improved forms made by Frost of Derby, who in concert with the late William Strutt, Esq., had the merit of inventing this very elegant automatic machine.

The tea le (tackle?) or hoist, consists of three principle parts.

1. The perpendicular shaft or pit, having a horizontal section, of about five or six feet square, placed in the most convenient part of the building, and extending from the ground-floor to the top story.

2. The ascending and descending plat-

form, suspended by ropes from pulleys, and moved up and down by machinery. It is a strong frame-work of timber, about six feet high, boxed up on three sides with deals, leaving the front side open, in correspondence with a series of doors on the several floors of the factory. The power required for hoisting is moderated by overbalancing the platform with two counterweights, together about a hundred weight heavier than itself, which ascend and descend equably with the descent and ascent of the platform; and which, as well as the platform, are suspended by ropes from the opposite sides of the shaft to secure a steady vertical motion. Two large planks are fixed upright upon the opposite walls of the shaft as guides to the platform, and two smaller ones as guides to the counterweights, the latter being sunk groovewise into the building.

3. The third part of the teagle is the machinery capable of being set in train with the moving power.

I shall give first a popular explanation of the principle on which the hoist operates.

Every observant visiter of a factory must have noticed that the endless strap or belt which descends from the drifting shaft to the steam pulley on the end of a carding, spinning, or weaving organ, sometimes has its two pieces running parallel to each other, as in that view, and sometimes has them crossed over each other.—The first arrangement, called the open strap, communicates motion in the one direction, while the other arrangement communicates motion in the opposite direction. Suppose now, that there is a fast pulley on the axis of any machine, and close to it, on either side, a similar pulley loose on the same axis; of which one is driven by an open strap, and the other by a crossed or close one. If the one strap be shifted upon the fast pulley, it will drive the machine in one direction, but if the other strap be shifted upon it, it will drive the machine in the opposite direction; that is, the machine according as it is driven by the open or close strap may be made to work upwards or downwards at pleasure, as in raising or lowering weights, &c.

When both belts are shifted upon the loose pulleys, the machine has no hold of the load, and would therefore allow it to fall by the influence of gravity, were there not some restraining power. This restraint is exercised by a *brake*, which presses strongly on the circumference of a wheel in train with the machinery, and fixes the whole by a force of friction proportional to the weight acting on the brake. Now, to move the load up or down, the brake must be removed at the same instant that the appropriate strap is shifted upon the fast pulley of the machine. The same contrivance which replaces the strap on the loose pulley, replaces the pressure of the brake on the friction-wheel.

Before describing minutely the structure of the hoist, it is proper to mention that all movements produced by straps ought to be pretty rapid, since, when slow, they are apt to permit a slipping of the bands on the surface of the driving-drums or pulleys. As, therefore, in this way, the pulley-shaft of the teagle would require too great a speed, for being connected directly with the hoisting rope, it transfers its motion, by means of a pinion and a wheel, to a second shaft, which travels at such a rate as to cause the platform to rise or fall through two feet in the second.

The drawings and description of the teagle are omitted, as being foreign to the general tenor of the article.

Dr. Vignet, first physician to the Military Hospital at Phalsburgh, has confirmed a discovery made by Dr. Viale, of the existence of insects in the Cholera. When Dr. Vignet was at the head of the hospital at Oran, he had upwards of 400 Cholera patients under his care, and ascertained to a certainty that the Indian Cholera is occasioned by myriads of insects, some visible to the naked eye and some not. He has published, at Metz, a work on this subject, and on the treatment he used in Africa in curing the disease.

American Rhenish. At Vevay on the Ohio, the vine is extensively cultivated by Swiss emigrants, who founded a colony there as early as 1804. Some of the vineyards have twenty acres in vines, which yield nearly 4,000 gallons of wine per year—worth from one to three dollars per gallon. The quality of the wine made at some vineyards, is pronounced by competent judges equal to the best Rhenish imported into this country.

BALLOON VOYAGE TO THE CONTINENT.

The public anxiety has been for some time excited by a report that it was the intention of three gentlemen to make the hazardous experiment of crossing the British Channel in a balloon, and that they resolved to ascend, not from the coast, but from the metropolis itself. The report appears to have been well founded, and, after several attempts on preceding days, which had been abandoned in consequence of the unfavorable weather; they took their departure yesterday from Vauxhall Gardens. The asscent was intended to be a private and not a public one, so far as the admission to the gardens or giving notice in the newspapers; but the secret was communicated to a few, and those persons, making in all about a dozen, eagerly embraced the opportunity of witnessing so remarkable an event. Mr. Holland, Mr. Mo ck Mason, and Mr. Green, have the honor and risk of departing on this voyage of discovery. They proposed, by regulating the ascent, to seek for such a stream of air as would take them, if possible, towards Paris, and if that should not be practicable, they would be guided by the current which might lead towards the Belgian capital. They do not appear to calculate on any wind prevailing but that from west-north -west or south-west, which would enable them to fulfill their design, and they boldly encounter all the hazard of being blown down Channel by an adverse breeze on the one side, or the North Sea on the other. They determined, in case they could not make the opposite coast, whether French or Belgian, to remain up in the air all night, and they took care to be provided with warm clothing and provision for such an unpleasant alternative.

The inflation commenced about seven in the morning, and by one everything was in readiness. The balloon was inflated almost to its utmost dimensions, and appeared capable of sustaining an aerial flight for many hours, or even days. In the car were upwards of a ton of ballast, several gallons of brandy and wine, a large supply of coffee, cold fowls, ham, etc., an apparatus, with unslacked lime, for heating the coffee, and, all appliances to insure comfort and prevent starvation and cold. There were also a supply of blue lights, stars, and other fireworks, to be let down at night, if the voyage were not accomplished before dark, in order to enable the æronauts to reconoitre the country from their elevation, and choose the point of their descent, and a number of parachutes, to which letters were fastened, to be dropped at intervals on the shores of the Continent, for the purpose of apprising the public of their transit, arrival, and safety—in a word, a more complete equipment cannot be conceived; and it was highly entertaining to see the preparations of the passengers, and the good humor and confidence with which they shook hands with their friends, and took their seats. They were also furnished with passports from the French and Dutch embassies, and with a letter for the King of Holland from his representative in this country. At one o'clock the inflation of the balloon being complete, the three gentlemen shook hands with their friends, and at a given signal majestically left the earth. The immense machine which held them rose splendidly from the Gardens, hung for a short time in sight of the persons who had collected to witness the daring attempt, and then, feeling the breeze which impelled it, glided away to the eastward, and was gradually lost to the straing eyes of the anxious crowd. The wind was perfectly fair for the French coast. The wind, however, by three o'clock veered more to the north, which would, of course, blow the balloon further to the southward of the French coast. Mr. Gye is already on the continent to receive the intrepid voyagers, and Mr. F. Gye, with Hughes, jun., started last night for Paris to welcome their arrival and to arrange preparations for an ascent from that metropolis. Whatever may be the result of this experiment, we regret that it was not put off till the ensuing spring or the early part of the summer, when a longer day and more favorable weather would diminish essentially the risks. It is also to be regretted that the travellers did not start soon after daybreak, instead of waiting till one in the afternoon, with only four or five hours of light before them.

FROM DOVER.—We have received the following account from a correspondent:—"*Dover five o'clock*, P. M. We were this afternoon highly gratified by witnessing the passing of Mr. Green's splendid balloon on his ærial voyage from London to the Continent, going a little to the eastward of the town, or very nearly over the Castle, the spot from which Jeffrey and Blanchard, some years since, took their departure to cross the Channel in a similar manner. A few min-

utes before five he signalised his departure from England by displaying a very brilliant light, which continued burning about ten minutes. The course of the balloon, on his crossing the Channel, was in a direction nearly E. N. E., with a gentle wind by the church vane W. S. W. Should he continue this course he will probably by morning in make the island of Walcheren, or South Beveland; or passing over these, continue his course to Holland. The altitude of the balloon was increasing as he approached Dover, and continued steady about the same as he passed from over *terra firma* to cross the Channel. The velocity of the balloon did not exceed four or five miles per hour. ***Half past Six o'clock.*** The balloon is not yet out of sight, its situation being distinguished by variegated lights."

Another Dover correspondent has transmitted us the copy of a note which was dropt from the balloon in a parachute near the village of Whitfield about two miles from Dover. The party appeared to be according to this informant going towards Dunkirk near the Belgic coast. The person who picked up the note was at work at Whitfield Mill, and, seeing the balloon descending, he stopped the mill to render assistance, when he saw the parachute coming down, from which he took the letter; it is as follows:—

"BOUND FOR THE CONTINENT."

"Mr. Green, Mr. Monck Mason, and Mr. Robert Holland, present their compliments to the Mayor of Dover, and beg to inform him that they left Vauxhall Gardens at half-past one o'clock, and were nearly over Canterbury at four o'clock.

"To the Mayor of Dover." [Globe.]

Items.

We have just learned that the Government of Prussia has placed a vast mass of the most valuable statistical information at the disposal of Mr. M'Culloch, to be used either for the improvement of his dictionary or otherwise, as he may think fit. This conduct reflects infinite credit on the intelligence and liberality of the Prussian Government. The information communicated is all official. It is in the shape of replies to queries transmitted to Berlin through his Excellency, Baron Bulow, who has taken the greatest interest in the matter. We have been assured that his Prussian Majesty, as well as his Ministers, was pleased to express his approbation of the object for which the information was sought, and his wish that it should be full and authentic. It may be questioned whether there be another Government in the world (certainly we know of none) that would, at the mere solicitation of a private individual—and that individual a foreigner—have taken so much pains to furnish him with the means of fairly appreciating and exhibiting its policy in an economical point of view.

[Chronicle.]

M. Chaix, a Frenchman who has been long a resident in the Isle of France, has discovered a simple and ingenious mode of preventing the formation of the crust which is generally found inside the boilers of steam-engines, and which, being formed principally of calcareous substances, prevents the transmission of heat from the furnace to the water. An experiment has been made on board the *Phare* steamer at Toulon, by order of the Minister of Marine, and was perfectly successful, showing that the process not only prevents new concretions, but even detaches and destroys a formed crusts.

Mme. Cheron was murdered at Maisons on the 14th of January, 1834. Two students having by some means obtained possession of her skull, fancied it indicated a remarkably avaricious disposition; and, in order to satisfy themselves whether their judgment was correct, submitted it to the examination of the celebrated phrenologist, Dr. Leroy, who fully confirmed their conclusions. A man who had managed her affairs for 20 years, and a physician who had long been intimate with her, were written to, and their answers established the scientific decision of it the Doctor by the evidence of facts showing that the deceased would acquire money *per fas et nefas*, and, though enjoying a revenue of about 6000 francs per annum, would live in the most miserable manner. Upon this, Dr. Leroy sent a detailed report to the Phrenological Society, which was read at a full meeting. The *Messager*, on the 28th August last, published the report, and mixed up the analysis of the cranium of Mme. Cheron with those of Lacenaire, Fieschi, and Avril. Upon this, the surviving relatives of Mme. Cheron brought a prosecution for defamation against Dr. Leroy and the *Messager*. The

trial came on yesterday before the Tribunal of Correctional Police, when, after a long hearing, the Doctor and the Editor of the *Messager* were acquitted.

A Good Beginning.—Mr. Charles Park has sent to the Patent Office a duplicate model of his "Patent Worming and Rope Serving Machine." This is an example worthy of all imitation. In acknowledging the receipt of the model, the superintendent of the Patent Office says:

"To you belongs the merit of having been first to aid thus in the restoration of the Patent Office, and I trust that the example, which you have given to the Patentees, with so much promptitude, will be extensively followed."

It has been impossible to form any calculation approaching to correctness of the amount of the population of Paris previous to the 15th century. Under Philip le Bel it was said to be 50,000. Under Louis XI., after the expulsion of the English, it was 150,000. In the middle of the 16th century it rose to 200,000 or 220,000. At the beginning of 1590, although reduced by the wars of religion, it was reckoned that there were 200,000. It, however, resumed its progressive increase under Henry IV. and Louis XIII. In the latter part of the reign of Louis XIV., and the first of the Regency, it amounted to very nearly 510,000. In 1762 it reached 576,000. In 1755 there were 71,114 families liable to taxes. In the reign of Louis XVI., Paris contained 600,000 inhabitants. In 1805 the number was 547,750; in 1817 it came to 713,966; in 1827 to 890,431; in 1831 to 774,338; and in 1832 to 770,286.—We are now assured that, according to a recent census, the population of this city amounts to about one million, and, consequently, has nearly doubled in the course of 31 years.—[French paper.]

Copper Smoke.—Attached to the new copper works belonging to Messrs. Vigors & Co., in Owm Avon, is a tunnel for consuming and conveying copper smoke 1100 yards in length, viz: from the smelting furnaces to the top of the high hill towards the north-west, called Mol-y-Mynyddan.—In this elevated spot the small quantity, if any, that will escape precipitation, will find its way into the air. Few persons, probably, are aware of the immense quantity of copper thus saved to the proprietor, which in former times was deposited on the neighboring lands, subjecting him to most expensive actions. In a tunnel not long made by Messrs. Williams & Co., in their works on the Swansea river, 200 tons of copper were taken out, which had been precipitated in the short space of one year—the value of this was 2000*l*., and much was still left in the tunnel. Chambers are made in the tunnel for attracting the smoke, which is further promoted by the use of steam, so that little of it is allowed to reach the place of exit till it has deposited in *transitu* all its substance. This material, therefore, which not only was formerly lost, but did serious mischief to the adjoining lands, thereby entailing lawsuits of ruinous expense, becomes now a matter of profit.

[Merthyr paper.]

In the course of September, a gold watch and other articles, given by Napoleon to the Abbe Buonavita, who was his chaplain at Saint Helena, were sold by auction at the Isle of France. The watch with its chain went for 755 piastres, a silver tea pot for 100 piastres, a sugar dish for 140, a silver goblet for 131, a pair of salt-cellars for 55, a small gold goblet for 253. a silver fork and spoon for 75, and another fork and spoon for 80, a pair of sugar-tongs for 105, a knife for 30, and the case in which the above articles were inclosed for 30 piastres, making a total of 1,756 piastres, or 9,500 francs. The purchaser of the watch, which Napoleon wore at the battle of Austerlitz, afterwards refused a very considerable sum for his bargain.

The Director of the Museum at Kertch, a town in the Crimea, on the Black Sea, lately discovered an ancient tomb of oblong shape, formed of very large hewn stones without any cement, containing a species of coffin in cyprus-wood, inclosing a bronze urn, with the cover firmly soldered on, in which were the remains of burnt bones.—Near the urn were two broken vases of alabaster, which, probably, contained odoriferous essences as used by the Greeks at their funerals. The shape of the urn, which has three handles, and is in very fine preservation, makes it of high interest and value. It is not perhaps possible to fix its precise date, but there is every reason to

believe, from the form and construction of the tomb, that it goes as far back as the first colonization of this country by the Greeks, that is, 150 years before Christ.

A valuable mine of copper has recently been discovered in the forest of Troncay, in the Nievre, and a company is being formed for the purpose of working it.

The *Journal de Rouen* observes, that the rapid extension of the silk manufacture in England must have a serious effect upon that of France. The exportation of silk from England during the last year exceeded that of the former by the amount of 8,000,000 francs. This is said to have arisen from the employment of steam mechanical looms, of which there are 1,700 in England, and of these 306 are in use in Manchester. By means of these looms, two women are now able to produce as much manufactured silk as six men could formerly without them.—The economy of labor, adds the journal, renders the English formidable opponents to the French in the foreign markets.

The following phenomenon was observed lately at Gluckstadt, on the Elbe, and at Stzehoil and Heilingenstedten on the Stoer. During the continuance of twelve hours, the tides of these rivers neither rose nor fell, the waters remained constantly at the same level, and the ships at anchor, instead of turning as usual at the flux and reflux, remained immoveable. Some persons attribute this to an earthquake in some distant country, as the same thing happened on the 1st November, 1755, the day of the great earthquake at Lisbon.

We learn from Naples, that Professor Zalm has recently discovered, at Pompeii, a table service in silver, comprising 44 plates, 1 large dish, 3 small vessels, 2 spoons, and 4 forks, of admirable workmanship. They are all in very good preservation, and were to be sent to the Royal Family at Portici.

We hear that the Board of Health of Paris is about to verify by experiments, on a large scale, the extraction of tallow by water, mixed with sulphuric acid, in one of the abattoirs, and particularly the quality of the tallow, resulting from this new process, which has been so successfully employed by a tallow-melter at Rouen. If this new mode should be approved, an important advantage will result in the salubrity of the melting-houses, and a greater still to the tallow trade.

At a recent meeting of the Warwickshire Society of Natural History and Archæology, Professor Buckland stated that he had discovered at Guy's Cliff the remains of an extinct species of animal, which had never before been found or mentioned by geologists, and that the Castle, Collegiate Church, and town of Warwick, were built upon a stratum utterly unknown to English geologists. Another discovery which he had made was, that the town of Leamington rested on the remains of animals which had existed in other times.—[Warwick Herald.]

New Manufactories.—It will be gratifying to all who take an interest in the welfare of Poughkeepsie, to hear that new and important branches of business, are, one after another, being established here, to contribute to the growth and prosperity of the town. Among the several new branches which have been commenced during the few last months, we are pleased to notice Mr. Hurlbert's Manufactory of Paper Hangings, which already manufactures about *one thousand pieces* of paper hangings per week.—A cursory examination of his papers, has impressed us with the belief, that for good taste in the patterns and getting up, as well as for skill in mixing the colors, and beauty and excellence in the finish, they will be found fully equal to the French papers, which have hitherto greatly excelled all others.

The Manufacture of Carpets, is another new business just commenced. One establishment is already partially in operation, another will commence operations in a few weeks. We have seen the first piece of superfine ingrain carpeting ever wove in Poughkeepsie. It is from the manufactory of Messrs. D. L. Starr & Co. The piece contains one hundred yards, and is of such an excellent quality as readily to pass for an important carpet. This establishment as well as the one getting up by Messrs. Delafield & Whinfield, is expected to be in full operation by the month of May. The two concerns will give employment to about 50 men, and manufac-

ture more than $100,000 worth of carpeting annually.

In addition to the above, Mr. Raymond has just put in operation a concern for spinning stocking yarn, which turns out about 50 lbs. of yarn per day.—[Poughkeepsie Journal.]

New mode of preparing Kerm's Mineral and the Golden Sulphur of Antimony.—By M. Musculus. For the golden sulphur of antimony, I take—

Lime slacked with a sufficient quantity of water,	6 parts.
Sub. carbonate of potash, or dry subcarbonate of soda,	4
Finely pulverized sulphuret of antimony,	2
Flower of sulphur,	1
Sand, well washed and dried,	8

Mix them all well together, and put them in a funnel or other separating vessel, with a few small pebbles or coarse bits of glass underneath, and cover the mixture with a layer of sand. Pour on this by degrees, cold water, until the filtered liquid is no longer precipitated by hydrochloric acid.

The liquid thus obtained is to be sufficiently diluted with pure water and treated with hydrochloric acid. The precipitate, or golden sulphur of antimony, is to be carefully washed, and dried in the common way.—The product is about equal to the sulphuret of antimony employed.

To prepare Kerm's mineral, proceed in the same manner, only leaving out the flower of sulphur. The liquid obtained is to be treated with a solution of bicarbonate of soda; or by passing through it a current of carbonic acid gas.

This method of preparing these two substances, by displacement, is new, and much more simple and economical, in time, and expense, than the usual mode, and the products are as fine and abundant. The proportions may not perhaps be so rigorously exact as further experience may dictate.—It is possible that a previous maceration may be useful.

Note by M. Boullay.—We have repeated the process of M. Musculus, and find that the golden sulphuret of antimony, which it yields, is very beautiful—the kermes is heavy and the color not very good, but by substituting the dry carbonate of soda for potash, and adding to the filtered fluid an equal volume of pure water, deprived of air by heat, prior to the precipitation, we have obtained the kermes in great abundance, light, and of fine bright color.

Thus the preparation of kermes, till now so embarrassing and capricious, will be extremely easy to practice, in small quantities as well as large, and the pharmaceuist will be no longer excusable in depending on commerce, now he can extract the kermes by simple lixiviation, in the cold, instead of long and reiterated ebullition.—[Journal de Pharm.]

Preservation of Cantharides.—The rapidity with which mites attack cantharides, and the fact that they devour the soft parts of the flies, which are the most active, render any mode of effectual preservation very useful.

An experience of ten years enables me to affirm, that the process of Appert will thoroughly preserve them. The bottles containing the dried and sifted flies, being thoroughly corked, and fastened with double pack thread, are to be placed upright in a kettle of water, which is to be heated to ebullition and kept boiling, for half an hour, the bottle remaining until the water gets cold. They may then be put away in any cool place. If the insects are pulverized on being first taken from the drying stove, again left in the stove for a few hours previous to their being bottled, and afterwards treated as above, they will be still more effectually preserved. The eggs of the mites which adhere to the cantharides, though they may escape the heat of the stove, are destroyed by the boiling temperature, in well closed bottles.—[Idem.]

Preparation of Extracts.—The usual mode of obtaining vegetable extracts is by the aid of *heat*, but it is well known that the medicinal properties of compounds are often essentially altered by changes of temperature, and that the proximate principles of plants on which the virtue of extracts depends, may therefore be subverted at the high temperature at which they are sometimes obtained.

Mr. Guillard proposes to avoid the risk of such a deterioration, by pounding the fresh plant in a mortar, pressing out the juice in the cold, and evaporating it by a current of air from a smith's bellows. In this way he has perfectly succeeded in procuring the ex-

tract of *Aconitum Napellus*, after pounding pressing and filtering, when the temperature of the laboratory did not exceed 10° to 13° cent,

A more perfect mode, perhaps, would be to evaporate by means of a vacuum, without heat, by which the agency of the atmospheric oxygen would be very much avoided, as well as that of increased temperature.—[Idem.]

Improvement in the Manufacture of Charcoal.—It is well known that there is a very great loss of the carbonaceous portion of the wood in the usual careless way in which charcoal is made; and yet the greater density which the coal acquires by this process, than by that of close distillation, renders its quality very superior for the purpose of reducing ores. This is probably owing to the slower carbonisation which the wood undergoes, by which its molecules are dilated with less rapidity and force

It has been ascertained by experiment, that when the interstices of the wood stacks for charcoal are filled with saw dust and the stack itself covered with it prior to the application of fire, the product of coal is from seven to nine per cent. greater than in the ordinary way. It requires rather more care in the beginning, to get the fire under way, and prevent its going out.

By covering, or mixing the charcoal with tar, before it is put into the furnace with ore, so great a degree of activity is given to the fire, it may be worth the experiment to ascertain whether it would not be good economy to employ the tar of certain districts in this way.—[Journal Conn. Usuelles, Mai. 1836.]

Process for determining the existence of Sulphurous Acid in Common Hydrochloric Acid. By M. Girardin, Prof. at Rouen.—Put into a glass about half an ounce of the hydrochloric acid to be tried, and add to it 120 to 180 grains of the protochloride of tin (common muriate of tin) very white and not altered by the air, stir it with a rod, and add to it two or three times as much distilled water, and agitate the mixture. If no sulphurous acid be present, nothing appears; the salt dissolves, and the fluid only becomes a little disturbed by the action of the air on the salt; but if the smaller portion of sulphurous acid be present, a cloud is immediately perceived, the acid becomes yellow, and when the distilled water is added, the odor of sulphuretted hydrogen is manifest, a brown appearance ensues, and a powder is deposited. These phenomena are so obvious, that there need not be a moment's hesitation with respect to the sulphurous acid.

Sometimes the brown color does not appear till after some minutes have elapsed.—The more sulphur, the deeper it is. The sulphuretted hydrogen is evident only when the water is added. The yellowish brown powder which subsides is a mixture of sulphuret and peroxide of tin.

This process will detect a hundredth part of sulphurous acid in the hydrochloric.—The method is now practised in the workshops of Rouen.—[Annales de Chim. Mars. 1836.]

A new process of Carbonisation, by the aid of the waste flame at the tops of high furnaces. By M. Virlet, mining engineer. This process has been practised more than a year by Fauveau-Delirs, forge master at Bievres, near Grandpre (Ardennes) as well as at several high furnaces in the neighborhood, with complete success. It seems to have resolved the problem, for a long time a matter of research,—to discover the means of economizing and turning to account, the great quantities of fuel which are entirely lost in the forests, by the common method of coal burning. It consists in allowing the heat of the coal kilns to go no farther than is necessary to drive off the water and the oxidatin gases. It appears to me to be destined to produce a revolution in forges. A patent for fifteen years has been granted for this improvement, to Houzeau-Muiron, and Fauveau-Deliars.

The following statement is taken from the books of the High Furnace of Montblainville, of results before and after the adoption of the new process:—

Seven cords of wood, of fifty to fifty-two cubic feet, gave, by the old process, four kilolitres (thirty-five cubic feet) of charcoal, producing 800 kilogrammes of cast-iron,—about one ton. To this must be added the market toll, which, in that district, is one-sixth, which brings the actual consumption of charcoal to four and two-third kilolitres for 800 kilogrammes of iron.

Three and a half cords, of the same dimensions, give, by the new method, the same quantity of charcoal, or four kilolitres, pro-

ducing the same quantity of iron, but less mixed, better, more tenacious, softer, and attended with less loss in blooming, whether by charcoal or pit coal.

There is no toll on the charcoal in the new process, for it is thrown into the furnace as soon as made, and while still warm. It is also proved that the furnace works more rapidly with the new charcoal, increasing the fabrication one-third; so that there is to be added to the advantage before mentioned a diminution in the general expenses of production, and a diminution of one-half in the quantity of wood consumed.*—[Annales des Mines, 1836.]

* In a circular which accompanies our French journals, issued by the above patentees, it is stated, that agreeable to the best analysis, wood contains thirty-five to thirty-seven per cent. of carbon, and that by the common mode of burning charcoal in the forests, only sixteen to seventeen per cent. is obtained. The annual consumption in France of wood, and in the reduction of iron ore, is from thirty to thirty-one millions of francs, more than one half of which, of course, is pure loss, by the common mode of carbonisation. By employing the waste heat of the furnace, they are able, with a simple and not costly appendage to convert the wood into compact charcoal, which possesses great calorific power, and represents almost the whole of the carbon contained in the wood, and preserves in addition, a portion of the hydrogen. The relative expense of the two modes is thus represented.

Old process.

	Fr.
7 cords of wood produces 40 kilolitres of coal,	42 00
Expense of coal burning in the forest,	3 00
Transport to the furnace of 40 kilolitres,	4 00
One-sixth for toll,	8 16
	57 16

New process.

	Fr.
3½ cords of wood, giving also 40 kilolitres of coal,	21 00
Transport of wood at 2½ fr. per cord,	7 00
Sawing and carbonisation at the furnace,	3 50
	31 50

Difference in favor of the new process 25 fr. 66c,

M. De Milly's Star Candle Manufactory, Paris.—The French appear to have effected a great improvement in candles, by separating the crystallizable portion of tallow, the stearine, from its other constituents, and rejecting the latter in the composition of their bougies. But stearine itself is a compound of stearic acid and glycerine, and it is the former only which is wanted in the preparation of the most perfect bougies.

To accomplish this more perfect depuration, the stearine is converted into soap, with lime, and this soap is then decomposed by dilute sulphuric acid, forming an insoluble precipitate of sulphate of lime, and leaving the crystallizable stearic acid free.

The saponification of the stearine with lime, is aided by a high temperature, (140° cent.=284 Far.) which produces a corresponding pressure on the liquid, and by suitable agitation. The stearic acid, when separated, is thoroughly washed by hot water and steam, and then set aside to crystallize in tinned vessels.

The cakes thus obtained are broken up, put into sacks, and subjected to the gradual action of a hydraulic press. The greater part of the oleic acid is thus forced out, with a variable portion of the solid acid which it carries with it, depending on the temperature.

The material thus obtained is still more completely purged by a cold pressure in other hydraulic presses, not less powerful, but arranged horizontally. This leaves the solid matter of a splendid pearly white, exempt from odor, but not yet sufficiently purified. It is melted again in water, sharpened with sulphuric acid, washed, and cast into moulds, when it becomes a crystalline mass, and is fit for the preparation of stearine candles.

The strong tendency to crystallization presented a formidable difficulty in the moulding of the candles. In the earlier manufactory of the improved candles this difficulty was overcome only by adding twenty-five to thirty-three per cent. of wax, to the purified stearic acid. This added greatly to the cost.

An attempt was made at improvement by adding about a thousandth part of arsenious acid, in powder, to the stearic acid. This pretty effectually cut the crystals, (as the workmen termed it) but the process was objectionable, diffusing a disagreeable odor in apartments where many of the lights were burning.

M. de Milly now employs a more simple process, exempt from all reproach, and which requires only five hundredth parts of wax. It consists in disturbing the crystallization by a rapid transition from the liquid to the solid state, effected by dipping the moulds momentarily in water, of about the temperature of congelation of the purified material, and then pouring in the melted substance at a temperature but little higher than the melting point. This ingenious management secures to this fine improvement all the success that could be hoped for.

The manufacture has become greatly extended; the wholesale price has been lowered from 2 fr. 25 c. to 1 fr. 75 c. and the retail price from 2 fr. 50 c. to 2 francs the metrical pound, while at the same time the quality of the article is much improved. A steam generator is used in De Milly's factory, for heating and in most of the mechanical operations, and about eighty people, men, women and children are employed in it.—[Bull. d'Encour. Mars. 1836.]

BRITISH ASSOCIATION.

From the Journal of the Franklin Institute.

TIDE OBSERVATIONS AT LIVERPOOL AND LONDON.

M. Lubbock being called upon to give an account of the recent discussion of tide observations, for which a liberal grant of money had been made by the Association, rose and stated, that through the indefatigable exertions of Mr. Dessiou, considerable progress had been made in the reduction of the observations made at Liverpool by Mr. Hutchinson.

The diurnal inequality of difference between the superior and inferior tide of the same day, which in the Thames was very inconsiderable, if not insensible, was found at Liverpool to amount to more than a foot; a matter upon which the learned gentleman laid considerable stress, as calculated to lead to important practical results. The object of these reductions was to compare the results of theory with these observations, and with those of Mr. Jones and Mr. Russell, made at the port of London. The principal objects of comparison were the heights of the several tides, and the intervals between tide and tide; and these were examined in their relations to the parallax and declination of the Moon and of the Sun, and in reference to local, and what may in one sense be called accidental causes, as storms, &c. Of this latter, one of the most curious, as well as important, is the effect of the pressure of the atmospheric column. The learned gentleman stated, that M. Duassy had ascertained, that at the harbor of Brest a variation of the height of high water was found to take place, which was inversely as the rise or fall of the barometer, and that a fall of the barometer of 0.622 parts of an inch, was found to cause an increase of the height of the tide, equal to 8.78 inches in that port. To confirm this interesting and hitherto unsuspected cause of variation, had been one principal object of the researches of the learned gentleman, and at his request, Mr. Dessiou had calculated the heights and times of high water at Liverpool for the year 1784, and compared them with the heights of the barometer, as recorded by Mr. Hutchinson for the same year; and by a most careful induction, it had turned out that the height of the tide had been on an average increased by one inch for each tenth of an inch that the barometer fell, *cæteris paribus*; but the time was found not to be much, if at all affected. Mr. Lubbock then proceeded to examine the semi-menstrual declination and parallax correction, and stated that the result was a remarkable conformity between the results of Bernouilli's theory, and the results of observations continued for nineteen years at the London Docks. But to render the accordance as exact as it was found to be capable of being, it was necessary to compare the time of the tide, not with that transit of the Moon which immediately preceded it, but with that which took place about five lunar half days. To explain this popularly, the learned gentleman stated, that however paradoxical it might appear to persons not acquainted with the subject, yet true it was, that although the tide depended essentially upon the Moon, yet, any particular tide, as it reaches London, would not be in any way sensibly affected, were the Moon at that instant, or even at its last transit, to have been annihilated; for it was the Moon as it existed fifty or sixty hours before, which caused the disturbance of the ocean, which ultimately resulted in that tide reaching the port of London. The learned gentleman then exhibited several diagrams, in which the variations of the heights of the tide, as resulting from calculations founded upon the theory, were compared with the results of observations. The general forms of the two curves which represented these two results, corresponded very remarkably; but the curve corresponding to the actual observations, appeared the more angular or broken in its form, for which the learned gentleman satisfactorily accounted, by stating that the observations were neither sufficiently numerous, nor sufficiently precise, from the very manner in which they were taken and recorded, to warrant an expectation of a closer conformity, or a

more regular curvature. When it is recollected that the observations are at first written on a slate, and then transferred to the written register, by men otherwise much employed, and whose rank in life was not such as would lead us to expect scrupulous care, it was not to be wondered at, if occasionally an error of transcript should occur, or even if the observation of one transit was set down as belonging to the next. When to tide these circumstances it was added, that the at London was in all probability, if not certainly, made up of two tides, one having already come round the British Islands, meeting the other as it came up the British Channel, it was altogether surprising that the coincidence should be so exact; and it was one among many other valuable results of these investigations, that it was now pretty certain that tide tables constructed for the port of London, by the theory of Bernouilli, would give the height and interval with a precision quite sufficient for all practical purposes, and which might be relied on as sufficiently exact, when due caution was used in their construction, and the necessary and known corrections applied. In conclusion, Mr. Lubbock said, the observations for the port of London had now been continued from the commencement of this century, and those for Liverpool, as we understood, about twenty-five years.

Prof. WHEWELL observed, that as, in the discussion of the relative level of land and sea, the tides of the ocean were an important element, he should preface the remarks upon that subject, which he intended to submit, by making a few observations upon the very valuable communication of his friend Mr. Lubbock. This communication he highly eulogized, and pointed, out to the Section the importance of many of the conclusions, should they prove hereafter to be generally applicable: but he expressed strongly his fears that this would not be the case. Observation had, in the instance of the tides, far outstripped theory, for many reasons, which it would be impossible to detail; but among the most prominent were the complexity of the problem itself involving the astronomical theories both of the Sun and Moon; the masses of these bodies; the motions of disturbed fluids, and local causes tending to alter or modify the general geographical effect of the great tide-wave at any particular place. It was upon a careful review of these considerations, that he was led to fear that it would be still many years before theory would become so guarded and supported by local observations; as to afford a sufficiently correct guide to be implicitly relied on in these speculations. He instanced the tides of the British Channel, which, in consequence of their excessive magnitude, afforded magnified representations of the phenomena, by which the deviations become more remarkable. At the port of Bristol, the tide rose to a height of fifty feet, while towards the lower part of the Channel they only rose twenty, and along other parts of the coast not quite so high. The most striking of Mr. Lubbock's conclusions was that by which it appeared that the ocean assumed the form of the spheroid of equilibrium, according to the theory of Bernoiulli, but at five transits of the Moon preceding the tide itself. By the calculations of Mr. Bent, however, it would appear, that although the observed laws of the tides at Bristol might be made to agree with Bernouilli's theory of equilibrium tides, by referring them to a certain anterior transit,—so far as the changes due to parallax were concerned, as also as far as those due to declination were concerned,—yet it turned out that this anterior period itself was not the same for parallax as for declination. The two series of changes have not therefore a common origin or a epoch; so that in fact there is no anterior period which would give thecretical tides agreeing with observed tides; and, therefore, at least the Bristol tides do not at present appear to confirm the result obtained by Mr. Lubbock from the London tides. The learned gentleman then illustrated these views by diagrams, by the aid of which he explained to the Section the luni-tidal intervals, and the curve of semi-menstrual inequality—(this latter term, and the doctrine connected with it, was introduced into the subject of the tides by the learned gentleman himself, and, as is admitted by all acquainted with the subject, with the most valuable result.)

RELATIVE LEVEL OF LAND AND SEA. Prof. WHEWELL then proceeded to give an account of the proceedings of the committee appointed to fix the relative level of land and sea, with a view to ascertain its permanence, or the contrary. He observed, that the committee had not taken any active, practical steps for the important purpose for which they were appointed, because they had met with many unexpected difficulties

requiring much consideration. It was, however, intended to appoint a committee for the same purposes, who should be furnished with instructious founded upon the views at which the former committee had by their labors and experience arrived. One method proposed was, that marks should be made along various parts of the coast, which marks should be referred to the level of the sea; but here the inquiry met us in the very outset—what is the proper and precise notion to be attached to the phrase the *level of the sea?* Was it high water-mark, or low water-mark? Was it at the level of the mean tide, which recent researches seemed to establish? In hydrographical subjects the level of the sea was taken from low water, and this, although in many respects inconvenient, could not yet be dispensed with, for many reasons, one of which he might glance at—that by its adoption, shoals which were dry at low water, were capable of being represented upon the maps as well as the land. The second method proposed appeared to the learned Professor to be the one from which the most important and conclusive results were to be expected. It consisted in accurately leveling, by land survey, lines in various directions, and by permanently fixing, in various places, numerous marks of similar levels at the time; by the aid of these marks, at future periods, it could be ascertained whether or not the levels, in particular places, had or had not changed, and thus the question would be settled whether or not the land in particular localities was rising or falling. Still further, by running on those lines, which would have some resemblance to the isothermal lines of Humboldt, as far as the sea coast, and marking their extremities along the coast, a solution would at length be obtained to that most important practical question,—what is the proper or permanent level of the sea at a given place? Until something like this were accomplished, the learned Professor expressed his strong conviction of the hopelessness of expecting any thing like accuracy in many important and even practical cases. As an example, he supposed the question to be the altitude of Dunbury Hill referred to the level of the sea. If that level of the sea were taken at Bristol, where the tide rises, as before stated, fifty feet, the level of low water would differ from the same level on the sea coast at Devonshire, where the sea rises, say eighteen feet; and supposing, as is most probable, the place of the mean tide to be true permanent level by no less a quantity than sixteen feet, which would therefore make that hill to appear sixteen feet higher, upon a hydrographical map constructed by a person taking his level from the coast of Devonshire, than it would appear upon the map of an engineer taking his level at Bristol. In the method proposed, the lines of equal level would run, suppose from Bristol to Ilfracomb in one direction, and from Bristol to Lyme Regis in the other, and by these a common standard of level would soon be obtained for the entire coast.

Professor Sir William Hamilton rose to express the sincere pleasure he felt at the masterly expositions of Mr. Lubbock and Professor Whewell. One conclusion to which Mr. Lubbock had arrived was to him peculiarly interesting, viz., that by which it appeared that the influence of the Moon upon the tides was not manifested in its effects until some time after it had been exerted, for a similar observation had recently been made by Professor Hansteen respecting the mutual disturbances of the planets. Mr. Lubbock rose to say, that the agreement between the results calculated from the theory of Bernouilli and those obtained from actual observation, were much more exact than Professor Whewell seemed to imagine; in truth, so close was the agreement, that they might be said absolutely to agree, since the difference was less than the errors that might be expected to occur in making and recording the observations themselves. Mr. Whewell explained that he wished to confine his observations to the Bristol tides, as these were the observations to which he had particularly turned his attention; and with respect to which, he should be able, at the present meeting, to exhibit diagrams to the section, which he felt confident would amply bear out his assertions respecting the tides. Mr. Lubbock stated, that so near, indeed so exact, had been the coincidence between the observations made at London and Liverpool, and the theory, that he was so strongly inclined to believe that that coincidence would be found at length to be universal. Professor Stevelly inquired from Mr. Lubbock, whether he did not think it quite possible that local causes might exist, which would be fully capable of producing the deviations from the theory of Bernouilli; as, for instance, in the case of Bristol, so ably insist-

ed upon by Professor Whewell, where the causes of the extraordinary elevation are the land-locking of the tide-wave, as it ascends the narrowing channel, and the reflexions of other tide-waves from several places. Now, particularly in the case of reflex tides, may it not so happen, and does it not, in fact, happen in several places, that they bring the actual tide to a given port at a time very different from that at which the influence of the Moon and Sun, if unimpeded, would cause it to arrive, and thus separate, as Professor Whewell had stated, the origin or epoch of the variations due, suppose to parallax and seclension, and even cause other deviations from Bernouilli's theory?—Mr. Lubbock replied, that unquestionably it might so happen; but, in his opinion, the discussion of a few observations, like those made at Bristol, could not be expected to point out very exactly the origin or epoch of either of the variations of parallax or declination, with sufficient exactness, to furnish secure data for determining that they did not correspond to any one, common previous transit of the Moon.

JERRARD'S MATHEMATICAL RESEARCHES.

Prof. SIR WILLIAM HAMILTON read his report on Mr. George B. Jerrard's mathematical researches, connected with the general solution of algebraic equations. He wished, in the first place, to inform the Section, that no part of the grant of 80*l.* had been expended, which the Association had so liberally placed at his disposal for the purpose of procuring the assistance of persons competent to verify, by numercial computations, the method of Mr. Jerrard. The reason that he had not deemed it necessary to resort to this expense was, that he had, at a very early period after the meeting of the British Association in Dublin, satisfied his own mind that the method of Mr. Jerrard entirely failed in accomplishing the solution of equations of the fifth and sixth degree; and he trusted that he should be able to lay before the Section, with as much clearness as the abstruse nature of the subject would admit of, the principal steps of a demonstration, which, to the mind of the learned Professor himself, at least, carried a complete conviction, that the method of Mr. Jerrard was not applicable until the equation, as a minor limit, had reached the seventh degree. In order that he might carry the Section fully along with him, Professor Hamilton stated, that it would be necessary to give again a rather detailed account of the peculiarities of the very ingenious notation, devised by Mr. Jerrard, for denoting certain algebraic processes, resorted to in the application of his method. The Professor then proceeded to detail to the Section the several steps of Mr. Jerrard's method, clearly marking the steps previously known to analysts, and such as Mr. Jerrard had the merit of originating. The principal peculiarity of *formulæ* seemed to be, that in an equation, transferred in a particular manner for the purpose of eliminating the co-efficients of the original equation, the co-efficients were so ingeniously obtained as to be entirely independent of the degree of the original equation, and therefore to be of a similar form in all possible equations, the solutions of which were sought. As soon as he had prepared these formulæ, the Professor proceeded to demonstrate to the Section, that from the very nature of their connexion with the original equation, they must fail in giving its solution, where it only rose to the fourth dimension, because he showed that this would involve the solution of an equation of the sixth degree, as a preliminary step. Equations, however, of this degree had been long solved, and it was only, therefore, in connexion with the generality of Mr. Jerrard's method, that its failure, as regarded them, was of any consequence. He then proceeded to give a similar demonstration of its failure, as regarded equations of the fifth and of the sixth degree; and during his discussion of this step of his demonstration he took occasion to show that Mr. Jerrard's method had succeeded in reducing equations of the fifth degree to tables of double entry—a discovery, upon the value of which he enlarged considerably, and highly eulogized and complimented the author; insomuch, that he stated that if the method had accomplished nothing but this alone, Mr. Jerrard would have received the congratulations of the scientific world. He then proceeded to show, that unless the index of the equation reached as a minor limit the number seven at least, a certain intermediate equation, concerned in the elimation, would be met with, along with a multiple of it, which, therefore, would not give a number of distinct results sufficient to complete eliminations; but, beyond that degree, he stated that he had satisfied himself that Mr. Jerrard's method would afford solutions of equations, which, even if they should, from

their complexity, or other causes, be useless to the practical or merely arithmetical algebraist, yet to those engaged in prosecuting inquiries involving purely symbolic algebra, he felt confident they would afford facilities and general methods of investigation, hitherto almost unlooked for and unexpected.

Mr. Babbage complimented Sir W. Hamilton upon the very lucid exposition which he had given of a subject which he characterized as bordering upon the very extremest limits of human knowledge, and congratulated Mr. Jerrard upon the success with which he had contrived so effectually to distinguish between the symbols of operation and those of quantity, in expressing the results of elimination. Engaged, as it was well known he was, in a branch of practical numerical science, he could not suffer himself to be supposed to look with indifference upon a discovery which, if it should even fail in affording any practically important assistance to his particular branch, must yet be admitted to afford the strongest promise of advantage to the more purely abstract branch of algebraic investigation. Professor Peacock observed, that during the progress of the discussion of this question he had not failed to remark the many advantages which must result to algebra from Mr. Jerrard's method, from the collateral improvements to which the prosecution of his principal object had led, partly in suggesting new, and hitherto unexplored, methods of elimination, and partly by leading to a notation, which so clearly distinguished between the marks of quantity and the observations and changes which were to be resorted to in reference to them; but as to the result itself, he need characterize it no higher, when he added, that it was an advance in the science, which it did not appear that the celebrated La Grange had ever contemplated, and which was not approached by the result of Stchernhausen.

EXPERIMENTS WITH A VIEW TO DETERMINE THE INTERIOR TEMPERATURE OF THE EARTH.

Prof. PHILLIPS stated that this subject had for a long period engaged the anxious attention of scientific men, both at home and upon the continent; that the most accurate, as well as numerous, experiments indicated a decided elevation of temperature as a more depressed station below the earth's surface was attained; even when the depths descended to were small, this elevation of temperature became large enough to arrest attention; in fact, the temperature of the air, of the water, of the rocks, and of the soil, was found to augment as we descended. But in order to ascertain, if possible, what portion of this heat arose from, or was connected with, an elevated temperature of the internal parts of the globe, as well as to ascertain whether the causes of those were local or universal, and, if possible, to arrive at the law of its distribution, it was deemed a matter of much importance to get rid altogether of the effect of the air's temperature upon the thermometer, as also the action of water, because the sources of the water in mines, &c. must be in most cases entirely beyond the reach of observation. All these circumstances induced the committee appointed by the Association to conduct experiments upon this subject, to take the temperatures of the rocks themselves alone, as the fundamental experiments. With this view, they had no less than thirty-six thermometers made and carefully compared, and, although they well knew that these thermometers, after all the care which had been bestowed upon their construction, were by no means perfect or exact, yet, as their errors had been carefully noted, by a comparison with the standard thermometers of the Royal Societies of London and Edinburgh, and each thermometer numbered, the errors admitted of an easy correction. Many of these thermometers had been already placed under the care of persons adequately instructed to conduct the requisite experiments, and some of them were still in the possession of the committee, who would gladly place them in the charge of any person giving adequate security that they should be applied to the purpose for which they had been procured. The method of using them was this: a hole large enough to receive one of the thermometers, was first drilled into the solid rock, at the bottom of the mine, pit, or other proper place of observation, to the depth of two or three feet at least; into this the thermometer was then introduced and suffered there to remain for a number of days sufficient to ensure the attainment of the temperature of the rock itself. The temperature of the air at the mouth of the pit, and, if possible, the mean temperature of the place, must be observed or obtained. Professor Phillips then stated, that observations had been made in this manner, and with some of these instruments, under the directions of Professor Forbes, at

mines in the Lead Hills, in Scotland, and that Professor Forbes would take some early opportunity of bringing these observations more immediately under the notice of the Section; at Newcastle, under the direction of Mr. Briddle; at Wearmouth, under the care of Mr. Anderson; near Manchester, and at Northampton, under the direction of Mr. Hodgkinson; and within a few days, Professor Phillips had been enabled, through the kindness of a friend, te place a thermometer in a deep coal mine at Bedminster, in this immediate vicinity (Bristol.) The results of these observations, so far as they had as yet proceeded, amply confirmed the fact of the increase of temperature in the parts under the earth's surface. As one example, the Professor stated, that in a mine, the perpendicular depth of which, below the surface, was 525 yards, the thermometer in the rock stood at 78°, while the temperature in the open air at the mouth of the mine, varied from 30° to 80°, the mean temperature of the place being 47½°.

Prof. Forbes then gave, from memory, an account of the experiments which he had been the means of instituting in the Lead Hills. Before he did so, however, he wished to state that he had been informed that an artesian well had lately been met with in granite, and he then gave a general description of artesian wells. It was to this effect: that heretofore, in making borings in certain districts through certain alternation of clays, and at length through certain rocks, a supply of water was reached, which rapidly rose through the boring to the surface, and continued to overflow at the top sometimes, as the term fountain indicated, in considerable quantity, and with considerable force. He instanced the artesian wells, or fountains, of the London clay districts; and added, that the temperature of these waters was found universally to increase with the depth of their source beneath the surface of the earth. Heretofore, no such well had been obtained by boring through the granite; and if the account, which he had received, were correct, and of its correctness he entertained little doubt, this would be a matter of considerable interest as well to the geologist as to those who were engaged in scientific pursuits similar to those now under consideration. The observations made under his direction in the Lead Hills, alluded to by Professor Phillips, were almost entirely conducted by Mr. Irvine. These obervations were particularly interesting, from the fact, that the mines, in consequence of a strike among the workmen, had not been worked for many months, and at the same time it most fortunately happened that they were self-drained, that is, by machinery worked by external power, without the aid of either animals or steam. This most fortunate concurrence of favorable circumstances, which could be expected to be met with in so very few instances, at once embarrassed the observations from many sources of error, which, but for this, would have still left considerable doubts of the results being, partially, at least, affected by the heat generated by animals residing and work in the mines, as well as of artificial fires kept up for the purposes of venti'ation or of originating power. It was upon these grounds that he perceived the importance of them, but had it not been for the valuable astistance afforded him by Mr. Irvine, who descended into the mine, and placed the thermometer and made the observations, he could scarcely have been as successful as the results already obtained warranted him in hoping he should be. These results, which, of course, had not as yet reached the degree of accuracy which he still looked for, lead to the conclusion that the temperature in that mine increased about 50 of Fahrenheit for a descent of ninety-five fathoms. Professor Stevelly stated, that as practical utility was one of the principal objects of the British Association, he might be permitted to add, that the waters of these wells, in consequence of their temperature being in genereal elevated above the mean temperature of the place at which they delivered their waters, had been applied to the very important practical purpose of freeing machinery of ice in winter, insomuch, that by their instrumentality, machinery, such as water wheels, &c., which had always previously been clogged by ice for a considerable part of the winter, to the great loss of the owner's manufactory, were, by the aid of the waters of these fountains, kept constantly free; while the same water has been, in some instances, conducted through the factory itself, with a view to keep up a uniform and elevated temperature within its walls, thus affording a second and a very valuable practical application.

WILKINSON'S ALARM.

Sir,—Among the "Notes and Notices" in your 687th Number, I observe one des-

cribing an "*alarm-lamp*," said to be invented by a gunsmith of Easingwold, in Yorkshire. I apprehend the writer has made some slight mistake with respect to this invention, which originated with Mr. Wilkinson, the justly celebrated gunsmith of Pall Mall, London.

Having constructed a percussion-lock upon a new principle about fifteen months ago, which I considered applicable to large pieces of ordnance, and knowing Mr. Wilkinson to be the very best authority upon these matters, I obtained an introduction to him. Mr. Wilkinson received me with the utmost politeness; and having examined my new lock, he pointed out, in the kindest manner possible, the reasons why it could not answer the purpose for which I had intended it. He then exhibited and explained to me many curious and ingenious things with which I found him surrounded, and, among other things, he showed me his *new alarm* for the detection of poachers, rick-burners, &c. This alarm consisted of a percussion-lock of a very strong and durable construction, fixed upon a stout post, from which wires were led in various directions over the grounds to be protected, in the same way as the wires of spring-guns used to be. The lock is made to communicate with a rocket or a maroon, or with both. In the event of any of the wires being touched, the lock is discharged, and striking a percussion-cap, ignites the maroon, the audible report of which alarms the persons who are on the look-out; a rocket at the same instant ascends, and remains stationary for five or ten minutes over the spot, throwing down a vivid light, which indicates the situation, and exhibits the progress of the depredators.

Mr. Wilkinson's alarm has been very extensively employed by noblemen and gentlemen for the protection of their property from midnight marauders, and it is the best contrivance for the purpose I ever met with. These alarms are in every way infinitely superior to the inhuman "man-traps and spring-guns," even were they still legal; they are properly described as "being perfectly free from danger to servants or others having the care of them; but calculated when they go off to strike terror into the breast of the most audacious depredator."

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, October 8, 1836.

IMPROVED PERPETUAL OVEN.—The silve medal was granted to *Jametel & Lemare* for an oven, the fuel of which is placed under ground, and in large mass. The doors of the furnace and ash pit being closed, no air gains access, except what filters as it were through the masonry. By this means the combustion continues a long time. The oven being long and continuous, the air which enters it is at first much heated, but being gradually cooled by the evaporation from the bread, it descends by its gravity, and again enters the oven to renew the process, thus maintaining a continued current, which regulates the temperature.

From the Journal of the Franklin Institute.

A BILL FOR THE REGULATION OF THE BOILERS AND ENGINES OF VESSELS PROPELLED IN THE WHOLE OR IN PART BY STEAM.*

TABLE OF CONTENTS.

§ 1. Requires an enrolment, and license of navigation.

§ 2. Provides a penalty for navigating without a license.

§ 3. Requires the appointment of an inspector of boilers and machinery, and defines his duties, &c.

§ 4. Requires a certificate to the inspector from the owner or master of a steamboat, of the pressure of the steam intended to be used.

§ 5. Makes provisions intended to secure the safety of boilers.

ART. 1. Requires two safety-valves.
2. Provides for the graduation of the first.
3. Fixes the maximum pressure to be allowed upon it.
4. Provides for the regulation of the second.
5. Requires the second to be inclosed so as not to be accessible except by the captain of the boat.
6. Puts the second under the control of the captain of the boat.
7. Regulates the least rise to be given to the lock-up valve.

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* The sections of this bill which are takon from that reported by the Committee on Naval Affairs, in the Senate of the United States, at the session of 1835–6, are marked by a note of reference to the sections of the latter.

8. Directs the form of the lever of the valve.
9 Provides for each two small cylinder boilers, one set of safety-valves.
10. Requires a mercurial-gauge for low pressure boilers, and prescribes its arrangement.
11. Provides that it shall be open to examination by passengers.
12. Requires a fusible metal apparatus to be attached to every boiler.
13. Directs the fusible metal to be inclosed.
14. Provides for its not being tampered with.
15. Inspector to compound the fusible metal.
16. Prescribes the composition of the fusible metal.

§ 6. Requires an examination into the fulfilment of the foregoing provisions, by the inspector, previous to giving certificates.

§ 7. Penalties for interfering in any way with any part of the apparatus provided for the safety of the boiler.

§ 8. Prohibits more than two contiguous boilers to be connected by a water-pipe.

§ 9. Penalties for the bursting of a boiler caused by a deposite.

§ 10. Prohibits boilers in which the metal is exposed to heat without being in contact with water.

§ 11. A thorough examination of the boilers, &c., required of the inspeector. Proofs directed and proof-pressure prescribed. Certificates to be given by the inspector to be posted up under the penalties prescribed. Fees of inspector.

§ 12. Proofs, &c., to be made every six moths. Circumstances under which a license may be forfeited.

§ 13. Requires the pumps for supplying the boilers with water to be kept at work, when a boat is stopped for a temporary purpose. Penalty prescribed.

§ 14. Qualifications for the office of inspector laid down.

§ 15. Penalties for explosions when the master or engineer is engaged in gambling, or is intoxicated. Also from racing, &c.

§ 16. A neglect to obtain or renew certificates as prescribed, to bar from the recovery of a claim for freight or insurance. Owners of boats to be in such cases responsible for loss, or damage by explosions.

§ 17. Penalties in case of explosion when the captain, &c. has neglected to have the required inspections made, and certificates issued.

§ 18. Provides a bounty for boats with boilers on the guards, and suitable bulwarks between them and the interior of the boat.

§ 19. Inspector to be dismissed in case of making false certificates, &c.

§ 20. Provides for the recovery of fines, &c. Proviso, that suits must be instituted within two years after the offence has occurred.

§ 1.*—*Be it enacted by the Senate and the House of Representatives of the United States of America, in Congress assembled,* ——; to make a new enrolment of the same under the existing laws of the United States, and to take out from the collector or surveyor of the port, as the case may be, where such steamboat or vessel is enrolled, a new license, under such conditions as are now imposed by law, and as shall be imposed by this act.

§ 2.†—*And be it further enated,* That it shall not be lawful for the owner, master, or captain, of any steamboat, or vessel propelled in the whole, or in part, by steam, to transport any goods, wares, and merchandize, or passengers, in, or upon the bays, That it shall be the duty of all owners of steamboats, or vessels propelled in the whole, or in part by steam, on or before the —— day of ——, one thousand eight hundred and lakes, rivers, or other navigable waters of the United States, from and after the said —— day of ——, one thousand eight hundred and ——, without having first obtained from the proper officer, a license under the existing laws, and without having complied with the conditions imposed by this act; and for each and every violation of this section, the owner or owners of said steamboat, or vessel, shall forfeit and pay to the United States the sum of ——.

§ 3.‡—*And be it further enacted,* That it shall be the duty of the President to appoint at such ports on the navigable waters, bays, lakes, and rivers, of the United States, as in his judgment will be most convenient

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* § 1. Of the bill reported in Senate U. S.

† § 2. Of bill, &c.

‡ From § 3 of the bill reported, &c.

to the owners and masters of steamboats, and vessels propelled in the whole or in part by steam, one or more persons who shall be practical mechanics, of competent skill, to make inspections of the boilers and machinery employed in such boats and vessels, whose duty it shall be to make such inspections, when called upon for that purpose, to give to the owner or master of such boat or vessel, duplicate certificates of all such inspections, and the said person, so appointed, shall, before entering upon the duties of said appointment, take an oath, before some competent authority, faithfully to discharge and perform the same.

§ 4.—*And be it further enacted*, That the owner, master, or captain of each and every boat or vessel propelled in the whole or in part by steam, shall certify, to said inspector, the greatest pressure, or total elastic force, of the steam intended to be produced in the boiler, which certificate shall regulate in the proofs, trials, and construction, hereinafter required.

§ 5.—*And be it further enacted*, That each and every boiler of a steamboat, or vessel propelled in the whole or in part by steam, shall be constructed, and arranged, so as to comply with the following provisions:

1. There shall be two safety-valves, each of which shall be competent to discharge the steam made in the ordinary working of the boiler.

2. The first of said valves shall be graduated by the maker of the engine, and have stamped upon the lever, by which it is weighted, the pressure at which it will by calculation open, when the appropriate movable weight is placed at the several marks. Said pressure to be the difference between the pressure of the steam within, and atmospheric pressure on said valve.

3. When the movable weight exerts its greatest pressure, the total pressure upon said valve shall not exceed the pressure as certified according to the provision of the fourth section of this act.

4. The second of said valves, denominated the lock-up valve, shall be immovably weighted, the total pressure upon it not to exceed said certified pressure.

5. Said lock-up valve, with its lever and other attachments, shall be inclosed in a grated box, or otherwise duly arranged so that it can be raised, but not pressed down, except as above provided, upon its seat.

6. Said inclosure, or arrangements, shall be secured with a lock, of which the captain or master of said boat shall alone have the key.

7. Said inclosure or arrangements, shall admit a rise in the valve of at least one-fourth of the diameter of its seat.

8. The lever of said valve shall be so constructed as on the rising of the valve, to diminish the effect of the acting weight, by at least one-tenth of the ordinary pressure derived from said weight.

9. When two boilers, each of not more than forty inches diameter, are connected by a steam-pipe, each pair of said boilers may be furnished with safety-valves, as described in this section, for a single boiler.

10. When the certified pressure provided in section fourth, does not exceed two atmospheres, each and every boiler shall be furnished with a mercurial-gauge, indicating by a float or rod, upon a duly graduated and marked scele, the excess of pressure within the boiler over atmospheric pressure in inches of mercury.

11. Said gauge and scale shall be so placed as to be readily examined by any and every passenger on board of said boat.

12. Each and every boiler shall be provided with a fusible metal apparatus of suitable form and dimensions, to be applied to the boiler itself, or to its flues, at the place which may be considered that of greatest heat, or most liable to exposure froma deficient supply of water.

13. Said fusible metal shall be contained in a tube to prevent its exposure to pressure, and shall on softening, communicate an alarm by some suitable device.

14. Said apparatus shall be duly secured from being rendered ineffective, in the manner of the lock-up safety-valve heretofore provided.

15. The fusible metal hereinbefore referred to, shall be compounded by the inspector, who shall place it in the apparatus as aforesaid, and shall satisfy himself that the whole is duly arranged as heretofore prescribed; for which service he shall receive, on certifying the same, a compensation of ——.

16. The said alloys shall be compounded according to the certified pressure of steam within the boiler, by the following table of parts, by weight, of the ingredients.

TABLE OF ALLOYS FOR USE IN CLOSED TUBES, AND WITH A METALTIC STEM.

3	24	2	14	Certified pressure in atmospheres.
8	8	8	8	Tin.
84.6	85.3	86.2	87.5	Lead.
				Bismuth
7	6	5	4	Certified pressure in atmospheres.
8	8	8	8	Tin.
80.5	81.2	82.2	83.4	Lead.
				Bismuth
11	10	9	8	Certified pressure in atmospheres.
8	8	8	8	Tin.
11.4	10.6	9.8	8.0	Lead
		13	12	Certified pressure in atmospheres.
		8	8	Tin.
		13.2	12.3	Lead.

§ 6.—*And be it further enacted*, That before delivering the certificate hereinafter to be provided for. the inspector, heretofore provided, shall examine the apparatus required by section fifth, and shall ascertain that all the provisions of that article are complied with.

§ 7.—*And be it further enacted*, That any person or persons whatsoever who shall wilfully overload or otherwise render inoperative said safety-valve or valves, or render ineffective said mercurial-gauge or gauges, by plugging up or stopping off, or in any other manner prrventing their action, or shall in any manner, impair, or interfere, with the usefulness of said fusible metal apparatus, shall for every offence be subject to the penalty of —— dollars, and to an imprisonment at the discretion of the court, not to exceed ——, and in case of accident to said steam-boiler, resulting from said offence, by which life is lost, shall be deemed to have been guilty of manslaughter, and punished according to law for said offence.

§ 8.—*And be it further enacted*, That not more than two boilers of a boat, or vessel, propelled in the whole or in part by steam, and those immediately contigious, shall have connected water pipes, nor shall the license heretofore provided for, be issued until the inspector has satisfied himself, and has certified, that the provision of this section is complied with.

§ 9.—*And be it further enacted*, That for each and every bursting of the boiler of a steamboat or vessel propelled in the whole, or in part, by steam, which shall occur from a deposite of sedimentary matter within a boiler, the master of said vessel, shall forfeit the sum of ——— dollars ; and that in case life shall be lost by the same, he shall be deemed to have been guilty of manslaughter, and shall be liable to prosecution acordingly.

§ 10.—*And be it further enacted*, That no boat or vessel propelled in the whole, or in part, by steam, shall be licensed until the inspector has certified on examination, that no part of the boiler of said boat is, ordinarily, directly exposed to flame, or to heated air from the draught, without the immediate contact of water.

§ 11.*—*And be it further enacted*, That it shall be the duty of the person who shall be called upon to inspect the boilers and machinery of any steamboat or vessel, in conformity to the provisions of this act, carefully, fully, and thoroughly, to inspect and examine the engine and machinery of said boat or vessel, and to state his opinion of their soundness : and he shall, moreover, provide himself with a suitable hydraulic pump, and, after examining into the state and condition of the boiler, or boilers, of said boat, or vessel, it shall be his duty to test the strength and soundness of said boiler, or boilers, by applying to the same a hydraulic pressure equal to three times the certified pressure which the boilers are to carry in steam ; and if he shall be of opinion, after such examination and test, that the said machinery and boilers are sound and fit for use, he shall deliver to the owner or master of said vessel or boat, duplicate certificates to that effect, stating therein the age of said boilers, and the pressure of steam which may be carried by them, and which shall in no case exceed one-third part of the proof-pressure, one of which certificates it shall be the duty of said master or owner, to deliver to the collector or surveyor of the port, whenever he shall apply for license or for renewal of license : the other he shall, under a pen-

* § 5 of the bill reported in the Senate of U. S. with slight verbal changes.

alty of —— hundred dollars for every day that he shall neglect so to do while the boat is running, cause to be posted up and kept in some conspicuous part of the boat or vessel, for the information of the public; and for each and every inspection of the said machinery, and inspection and test of the said boiler or boilers, the said inspector shall be allowed and paid by the owner or master thereof, and before the delivery of said certificates, the sum of —— dollars.

§ 12.*—*And be it further enacted*, That it shall be the duty of the owners or masters of said boats or vessels, to cause the examination of the machinery, and the examination and test of the boilers, as provided in the sections of this act, to be made, at least, once in every six months; and to deliver to the collector or surveyor of the port where such boat or vessel, has been enrolled or licensed, the certificate of such inspection; and on failure thereof, he or they, shall forfeit the license granted to such boat or vessel, and be subject to the same penalty as though he had run the said boat or vessel, without having obtained such license.

§ 13.†—*And be it further enacted*, That whenever the master of any boat, or vessel, or the person, or persons, charged with the navigating said boat or vessel which is propelled in the whole or in part by steam, shall stop the motion, or headway, of said boat, or vessel; or the said boat or vessel, shall be stopped for the purpose of discharging, or taking in cargo, fuel, or passengers; he, or they, shall keep the engine of said boat, or vessel, in motion sufficient to work the pump, and give the necessary supply of water, under the penalty of —— dollars for each and every offence in neglecting or violating the requirements of this section.

§ 14.‡—*And be it further enacted*, That no other than a practical mechanic who shall be of the age of twenty-one years, or upwards, shall have served two years in a steam engine factory, or general machine making establishment, and who shall have a thorough knowledge of the working of an engine, and shall produce satisfactory testimonials of steady habits, shall be employed as an engineer on board of any boat or vessel propelled in whole or in part by steam, provided that for every violation of this section, the owners or master of said boat or vessel shall forfeit the sum of ——— dollars.

§ 15.*—*And be it further enacted*, That for every explosion which shall happen from any cause whilst the captain, master, or engineer shall be engaged in gambling, or attending to any game of chance, or hazard, or shall be intoxicated, or which shall happen from racing, or from carrying higher steam than the quantity authorized by the certificate, the owner of such steamboat, or vessel, shall be subject to the penalties provided for in the sixteenth section of this act; and the captain, master, or engineer shall be respectively subject to the penalties hereafter provided in the seventeenth section of this act.

§ 16.†—*And be it further enacted*, That any owner or master, of any steamboat, or vessel propelled in the whole or in part by steam, who shall fail to obtain, or neglect to renew, the certificates of examination hereinbefore provided for in the several sections of this act, shall be barred from the recovery of any claim for freight or insurance that may accrue when without said certificate, and should any loss or damage to property, or injury to persons, in such case occur in consequence of the breaking of any part of the machinery, or bursting of the boiler or boilers, the owner shall be responsible to the full amount of said loss, damage, or injury.

§ 17.‡—*And be it further enacted*, That the captain or master of any boat or vessel propelled in the whole or in part by steam, which may not have been examined, and obtained the certificates required by the several sections of this act, shall in the event of loss or damage to property, or injury to persons, occasioned by the breaking of any part of the machinery, or the bursting of the boiler, or boilers, be subject

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* From § 6 of the law reported in the Senate of U. S., the period for making the inspections of the boilers, &c., is here proposed to be extended to six months.

† From § 7 of the bill reported in the Senate, &c.

‡ The Committee propose this section as a substitute for the 16th section of the bill reported in the Senate. That section requiring an examination of engineers by the inspectors.

* From § 13th of the bill reported, &c,

† From § 11th of the bill, &c.

‡ From § 12th of the bill, &c.

to a fine of not less than ———, nor more than ——— dollars, and an imprisonment of not less than ———, nor more than ———; and that in event of loss of life being the result of such accident, then said captain, or master, shall be adjudged guilty of manslaughter.

§ 18.—*And be it further enacted*, That any boat or vessel propelled in the whole or in part by steam, which shall have its boilers upon the guards of the boat, and shall have between them, and the interior of the boat, or vessel, a sufficient bulwark of timber, or other suitable material, so that passengers shall be protected effectually from injury in the event of explosion, shall be, on a certificate to the foregoing effect from the inspector heretofore provided, exempted from the payment of fees for the taking out of the license of navigation, and shall have remitted one half of the fees for proving and for other purposes of precaution heretofore provided. The fees remitted in such case to be assumed and paid to the respective officers by the United States.

§ 19.*—*And be it further enacted*, That for any false certificate, or one given without the thorough examination contemplated by this act, the inspector herein provided shall be dismissed from office, and fined not less than ——— dollars, nor more than ——— dollars, and imprisoned not less than ———, nor more than ——; and shall be incapable of ever being re-appointed to said office.

§ 20.†—*And be it further enacted*, That all penalties, fines and forfeitures imposed by this act, may be sued for and recovered in any court of the United States of competent jurisdiction within the district, or circuit, where the same may have been incurred, in the name of the United States —one half for the use of the informer, and the other half to the use and benefit of the United States.

Provided, That all suits, actions, or indictments instituted, commenced, or found, under this act, shall be commenced or found, within two years after the offence has been committed, or the cause of action accrued.

* § 17th of bill reported, &c.

† § 18th of bill, &c, with the addition of the proviso at the close of the section.

GREAT CURIOSITY, AND WONDREFUL EFFECTS OF THE EXPANSION OF WATER BY FREEZING.

The attention of many of our curious and scientific citizens was yesterday very pleasingly arrested, by an occurrence at the iron foundry of Messrs. Harkness, Voorhees & Co., in this city, exhibiting a specimen of the extraordinary power of the expansion of water by freezing.

An immensely large iron anvil, weighing between three and four tons, and measuring nearly three feet in diameter, had been left lying by the door of the furnace, exposed to the atmosphere. The anvil was perfectly solid, with the exception of a very small crack or crevice in the centre of one of the sides, about five inches long, and about four inches in depth, which from the rain had become filled with water. The quantity of water which the crevice contained could not have exceeded half a gill. In the course of the night of the 20th December, this water became frozen, and, extraordinary as it may appear, its expansion completely severed in two parts the immense mass of solid iron, and so great was its expansive power, that when the separation took place, a large log of wood which lay on the top of the anvil, was thrown to a distance of several feet.

Had the crevice been filled with powder, and the powder ignited, the effect would not have been a thousandth part as great.

We doubt not this interesting fact will be noticed with interest by the scientific curious throughout the United States.—[Cinciti Whig.]

The tremendous expansive power of freezing water has been proved, by a number of experiments, no less remarkable than the incident above described. We remember reading an account of one made at Woolwich, in England, several years ago, which gave an amazing proof of the power in question. An iron thirty-two pounder was prepared with an iron plug or tompion, twelve inches long, made to screw into the mouth of the piece with a very close and deep-cut worm, (or spiual groove); the cannon was filled with water, the plug screwed in, and moreover fastened with strong chains and ropes to the axles; and thus charged, it was exposed to the cold of a severe winter night. In the morning the chains and ropes were found broken, the worm destroyed, and the plug driven bodily out, while a cyl-

inder of ice occupied half the space it had previously filled.

In Norway it is a constant practice with the mill-stone quarries to avail themselves of this irresistible expansive force. They quarry out large cylinders of stone, long enough to make six or eight mill-stones of the usual thickness; then drill a number of holes, about six inches deep, in the circumference of the cylinder, so as to girdle it by rings of holes, at the proper distances. Into these holes are driven wooden plugs, perfectly saturated with water, and the frost soon splits the cylinder into as many blocks as there are circles.—[N. Y. Com.]

Pork Establishment of Mexico.—There exists in Mexico a very fine race of hogs, which are regarded as an important article of commerce, and the care which is taken of these animals so far surpasses that which I have seen elsewhere, I think it may be very useful to our farmers, brewers, and distillers, to be made acquainted with the principal details.

The buildings of these establishments include a house for the manager and the workmen, a shop, a slaughter house, a place for singeing, rooms and vessels for the fat and lard, (articles which often supply, in Mexico the place of butter) other rooms where black pudding is made and sold to the poor, and a soap manufactory, in which all the offals are used. The stables, which contain about 800 hogs, are behind these buildings. They consist of out-houses, well made, thirty feet deep, with overhanging roofs. The entrance is by a low vault, in front of which is an open space twenty-four feet wide, extending the whole length of the yard. In the centre of this is a stone aqueduct, through which flows clear water from a well or spring, the hogs being allowed to pass their snouts only, into the stream, through openings in a wall, which prevents their soiling the beverage. It is the only liquid they are allowed to take. They are fed with Indian corn, slightly moistened, and spread upon the floor. The pens and the space on which the animals walk are kept in great cleanliness.

The hogs are in the immediate charge of a number of Indians, attached to the establishment, and who often give them a cold bath, for it is thought that cleanliness contributes to that prodigious increase of fat which constitutes their principal value. It is the business also of these care takers to keep them in good humor. Two persons are employed from morning to night in adjusting their quarrels, and in singing to induce them to sleep. These persons are chosen on account of the strength of their lungs and ability to charm the ears of their amiable associates, which is deemed an affair of no inconsiderable merit!

The proprietor of one of these establishments assured us that the expense of it amounted to 300,000 francs, and that the sales rose to 10,000 a week, the luxury of his equipage indicated, in fact, the possessor of a large fortune.

METEOROLOGICAL RECORD

For the month of Snptember, 1836, kept at Avoylle Ferry, Red River, La., (Lat. 31° 10′ N. Long. 91° 59′ W.,) by P. G. Voorhies.

SEPTEMBER.

Days.	Morn.	Noon.	Night.	Wind.	Weather.	REMARKS.
1	65	86	82	calm	clear	
2	68	84	81	..	..	
3	70	86	81	..	..	even'g cloudy, night thunder and rain
4	74	80	76	sw	cloudy	thunder, in the morning heavy storm
5	74	76	79	calm	..	rain in the morning and clear at noon
6	72	82	80	..	clear	foggy morning
7	70	84	76	..	.	rain in the morning
8	71	82	80	..	cloudy	heavy rain from the south at noon
9	72	82	74	..	..	rain at noon from the south
19	71	80	76	w	..	heavy thunder in the afternoon
11	71	86	74	calm	..	thunder in the morning and rain at noon
12	74	72	71	sw	..	heavy thunder and lightning, and rain at noon
13	72	79	82	calm	cloudy	all day
14	74	82	76	se	..	heavy rain in the morning and clear at noon
15	72	85	75	calm	..	in the morning, rain, and clear at noon
16	73	84	74	..	clear	
17	73	82	76	..	cloudy	at noon heavy rain from s. e., and rain all night
18	74	78	80	..	..	heavy rain in the morning and clear at noon
19	75	84	80	..	..	Red River rising & showers in the morning, clear at noon
20	76	84	75	..	..	cloudy in the morning and rain all day
21	75	84	76	..	clear	
22	74	83	73	..	..	
23	72	84	74	..	..	
24	75	81	75	sw	cloudy	clear at noon, Red River falling
25	73	84	74	calm	..	
26	74	82	80	..	..	clear at noon
27	72	85	83	..	clear	.. .. rain all night
28	73	82	76	..	cloudy	clear at noon
09	66	82	76	..	clear	
30	62	76	68	w	..	

Red River fell this month 5 feet 6½ inches—below igh water mark 19 feet 4½ inches.